STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
OFFICE OF PUBLIC WORKS

Water Resources
TECHNICAL REPORT
No. 18

GROUND-WATER RESOURCES OF WASHINGTON PARISH, LOUISIANA

Prepared by
UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
In cooperation with
LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
OFFICE OF PUBLIC WORKS
1979

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By

H. L. Case III
U.S. Geological Survey

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STATE OF LOUISIANA

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UNITED STATES GEOLOGICAL SURVEY

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GLOSSARY

Aquifer
A formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs.

Artesian well
A well in which the water level rises above the base of the bed confining the aquifer; an artesian well may be either flowing or nonflowing.

Cone of depression
The depression, roughly conical in shape, produced in a potentiometric surface by pumping (or artesian flow).

Confining bed
A body of "impermeable" material stratigraphically adjacent to one or more aquifers that serves to confine water in the aquifer so that the water level rises above the base of the confining bed.

Dip
The angle at which a stratum is inclined from the horizontal.

Hydraulic conductivity
The volume of water at the existing kinematic viscosity that will move through a unit area of an isotropic porous medium in unit time under a unit hydraulic gradient through a unit area measured at right angles to the direction of flow. Replaces the term "field coefficient of permeability." The hydraulic conductivity multiplied by 7.48 is equal to the coefficient of permeability. For conversion of hydraulic conductivity in feet per day to meters per day, multiply by 0.3048.

Milligrams per liter (mg/L)
For the purpose of converting to the metric system the unit "milligrams per liter" replaces the unit "parts per million," formerly used by the U.S. Geological Survey. The two units are equivalent at dissolved-solids concentrations of less than about 7,000 mg/L.

Potentiometric surface
The surface which represents the static head with reference to a specified datum, such as National Geodetic Vertical Datum of 1929 (NGVD). As related to an aquifer, it is defined by the levels to which water will rise in tightly cased wells. The water table is a particular potentiometric surface.

Recharge
The process by which water is absorbed and added to the zone of saturation, either directly into a formation or indirectly by way of another formation.

Specific capacity

The rate of discharge of water from the well divided by the drawdown of water level within the well. It varies slowly with duration of discharge, which should be stated when known. Commonly expressed in gallons per minute per foot of drawdown for a specified period of continuous pumping at a constant rate.

Storage coefficient

The volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head.

Transmissivity

The rate at which water of the prevailing kinematic viscosity is transmitted through a unit width of the aquifer under a unit hydraulic gradient. It is equal to an integration of the hydraulic conductivities across the saturated part of the aquifer perpendicular to the flow paths. (Formerly termed "transmissibility," defined as the rate of flow of water, at the prevailing water temperature, in gallons per day, through a vertical strip of the aquifer 1 foot wide extending the full saturated height of the aquifer under a unit hydraulic gradient.) The transmissivity multiplied by 7.48 is equal to the coefficient of transmissibility. For conversion of transmissivity in feet squared per day to meters squared per day, multiply by 0.093.

Water table

That surface in an unconfined water body at which the pressure is atmospheric (water level below the top of the aquifer). It is defined by the levels at which water stands in wells that penetrate the water body just far enough to hold standing water.

FACTORS FOR CONVERTING INCH-POUND UNITS TO INTERNATIONAL SYSTEM (SI) OF METRIC UNITS

Multiply inch-pound units	By	To obtain SI units
foot (ft)	0.3048	meter (m)
foot per day (ft/d)	0.3048	meter per day (m/d)
foot per mile (ft/mi)	0.1894	meter per kilometer (m/km)
foot per year (ft/yr)	0.3048	meter per year (m/yr)
foot squared per day (ft^2/d)	0.09290	meter squared per day (m^2/d)
gallon per day per foot [(gal/d)/ft]	0.01242	meter cubed per day per meter [(m^3/d)/m]
gallon per day per square foot [(gal/d)/ft^2]	0.04075	meter cubed per day per meter squared [(m^3/d)/m^2]
gallon per minute (gal/min)	0.06309	liter per second (L/s)
	3.785×10^{-3}	meter cubed per minute (m^3/min)
inch (in.)	2.540	centimeter (cm)
inch per year (in/yr)	25.40	millimeter per year (mm/yr)
mile (mi)	1.609	kilometer (km)
million gallons per day (Mgal/d)	3.785×10^{6}	liter per day (L/d)
	3.785×10^{3}	meter cubed per day (m^3/d)
square mile (mi^2)	2.590	square kilometer (km^2)

(To convert temperature in °C to °F, multiply by 9/5 and add 32.)

GROUND-WATER RESOURCES OF WASHINGTON PARISH, LOUISIANA

By H. L. Case III

ABSTRACT

Freshwater-bearing aquifers in Washington Parish, La., were pumped at an average rate of more than 31 million gallons per day in 1974. The aggregate thickness of freshwater-bearing sands ranges from 850 to 1,910 feet, and the altitude of the base of freshwater ranges from 1,870 to 3,320 feet below National Geodetic Vertical Datum of 1929 (NGVD).

The shallow aquifer in Washington Parish ranges in thickness from less than 50 feet to more than 400 feet. In local areas, wells completed in the shallow aquifer are capable of yielding as much as 2,900 gallons per minute. The depths of wells in the shallow aquifer range from less than 100 to 420 feet below land surface. Water levels in wells in the shallow aquifer range from more than 10 feet above to more than 130 feet below land surface. More than 10 million gallons per day was withdrawn from the aquifer in 1974. Water from the shallow aquifer is generally low in dissolved solids, iron, and manganese concentrations; pH is generally less than 6.0 units.

Eight major freshwater aquifers are available in the Bogalusa area. Individual aquifer thicknesses range from 50 feet to more than 360 feet, and well depths range from less than 50 to 2,203 feet below land surface. Water levels in the "1,500-foot" sand are declining at a rate of about 2.5 feet per year, but significant water-level trends have not developed for other aquifers. Water from the "100-foot," "1,300-foot," "1,500-foot," and "2,200-foot" sands is generally low in dissolved solids, iron, and manganese; pH ranges from 5.2 to 8.8 units. Water from the "700-foot" sand and Ramsay aquifer contains iron concentrations ranging from 0.86 to 2.7 milligrams per liter, and manganese concentrations ranging from 0.04 to 0.18 milligram per liter; pH ranges from 6.2 to 7.3 units.

Four major aquifers have been identified in the Franklinton area. Thicknesses range from 100 feet in the Kentwood aquifer to 250 feet in the Franklinton aquifer. Well depths range from 585 feet (Kentwood aquifer) to 2,746 feet (Franklinton aquifer) below land surface. Water

levels in the Franklinton area range from more than 20 feet above land surface (Kentwood aquifer) to more than 100 feet below land surface (Franklinton aquifer). Water from the Kentwood and Franklinton aquifers contains low concentrations of dissolved iron and manganese. Water from the Tchefuncta aquifer contains dissolved iron concentrations in excess of 1.0 milligram per liter.

INTRODUCTION

Purpose and Scope

Residents, industry, and agriculture in Washington Parish, La., used approximately 31 Mgal/d of ground water in 1974. This demand places a stress on the hydrologic system that may eventually cause significant changes in the system. The purpose of this report is to define and describe the hydrologic framework of the ground-water resources of Washington Parish, La., to enable appraisal and orderly development of the resources. A second purpose was to provide baseline hydrogeologic data for future reference and comparison.

The scope of the investigation for this report included (1) a general description of the ground-water resources for the entire parish and (2) detailed descriptions of the ground-water conditions in the Bogalusa and Franklinton areas. The parishwide investigation included correlating aquifers in Washington Parish with aquifers in adjacent areas and preparation of geohydrologic sections to show lithologic correlations and variations. Water-use, water-quality, and water-level data for the parishwide shallow aquifer system and deeper aquifers are also presented. Freshwater aquifers in Washington Parish are further described by maps showing the base of freshwater and aggregate sand thickness.

Approximately 62 percent of Washington Parish's population lives in or near the Franklinton and Bogalusa areas, and these areas account for more than 87 percent of the ground water pumped in the parish. The major sands in the Bogalusa and Franklinton areas are described in terms of thickness and extent, well yields and aquifer characteristics, water levels and trends, water use, and water quality. For the Bogalusa area, a north-south geologic section was prepared, and the relations between the Pearl River and the "100-foot" sand were described.

Setting

Washington Parish consists of 677 mi^2 of rolling hills and stream-valley flatlands in the extreme northeast corner of southeastern Louisiana (pl. 1) and is part of the East Gulf Coastal Plain physiographic province. The Pearl River between Washington Parish and Pearl River County, Miss., forms the east boundary; and the Tchefuncta River between Washington and Tangipahoa Parishes, La., forms most of the west boundary. A popular recreational river, Bogue Chitto, flows from Mississippi into

Washington Parish near Warnerton, La., thence through Franklinton and Enon, La., and eventually empties into the Pearl River in northeastern St. Tammany Parish, La. Normal precipitation at Bogalusa, La., is about 60 in/yr; normal annual average temperature is 66.9°F (19.4°C).

Ground water in Washington Parish occurs under both unconfined (water-table) and confined (artesian) conditions. Both flowing and non-flowing artesian wells tap the deep Miocene sands in Franklinton and Bogalusa. Wells completed in the shallow, Quaternary, and Pliocene and Miocene sands in the valley lowlands commonly flow. Depths to water in 1976 for wells in Washington Parish ranged from more than 130 ft below land surface at well Wa-115 (198 ft deep) to more than 35 ft above land surface at well Wa-87 (730 ft deep). See plate 1 for the location of all wells cited in this report. Water-level data for aquifers in Washington Parish are available in published reports by the U.S. Geological Survey and in table 1 of this report. Data for wells that have been measured routinely over the years as part of the U.S. Geological Survey's network for the State of Louisiana are listed in Louisiana Water Resources Basic Records Report No. 7 (U.S. Geological Survey, 1975b, p. 504-514) and in "Water Resources Data for Louisiana" (U.S. Geological Survey, 1975a, p. 807-808; 1976, p. 780-781; 1977, p. 364-366; 1978, p. 340-342). Data for additional wells that were measured specifically during this project to obtain a broader coverage of aquifers are listed in table 1.

The quality of ground water differs among aquifers in the parish and may vary with depth within an aquifer. Iron concentration and pH are generally the two most critical parameters in determining acceptable quality in Washington Parish. Concentrations and units for dissolved iron and pH range from 0.0 to 2.5 mg/L (milligrams per liter) and from 5.2 to 9.1 units, respectively.

Previous Investigations

Washington Parish, or parts of the parish, has been studied in varying degrees by previous investigators. Winner (1963) described a general reconnaissance study of the Florida Parishes, including Washington Parish. Selected aquifer characteristics, water-level trends, and chemical analyses were presented, along with a large-scale base-of-freshwater map.

Nyman and Fayard (1978) describe in detail the ground-water resources of St. Tammany and Tangipahoa Parishes. Their report includes geologic sections and correlations with aquifers in adjacent Louisiana parishes and counties in Mississippi. For each major aquifer in their study area, they discuss the aquifer's hydrologic properties, water use, water quality, and water-level trends.

Howe (1962) provides deep-zone geologic correlations, structure-contour maps, and other information for sections of St. Helena, Tangipahoa, Washington, and St. Tammany Parishes, La. He examines the regional structural trends for the Miocene and older sediments in the area.

The Miocene aquifer system in Mississippi is described by Newcome (1975). His study presents a base-of-freshwater map, general geologic sections, and selected quality-of-water data for an area that includes the counties adjacent to Washington Parish.

Additional geologic information for Mississippi counties adjacent to Washington Parish is available from Brown, Foster, Adams, Reed, and Padgett (1944); Taylor, Humphreys, and Shattles (1968); and Brahana and Dalsin (1977). These reports describe the geology and provide geologic sections. Taylor, Humphreys, and Shattles (1968) also present information on the Pearl River alluvium.

Fisk (1944) discusses the general geology and structural geology of the lower Mississippi River valley. Although regional in scope, his report is useful in understanding the influence of the regional geology on the sediments in Washington Parish.

Acknowledgments

This report is a product of the cooperative program for water-resources investigations in Louisiana by the U.S. Geological Survey with the Louisiana Office of Public Works, Department of Transportation and Development. Data on bridge borings in the Bogue Chitto and Pearl River alluvium were provided by the Louisiana Office of Highways, Department of Transportation and Development. Many geophysical logs used in this study were obtained from the Louisiana Office of Conservation, Department of Natural Resources.

Messrs. Harold Marquart and Adrian Case, past and present city engineers for the city of Bogalusa, and Mr. Herb Minarik, water superintendent for the town of Franklinton, were very helpful, patient, and unselfish with their time and resources. Mr. George Arceneaux, utilities superintendent with Crown Zellerbach Corp., in Bogalusa, provided well-completion records and permitted water-level measurements and water sampling of plant wells.

Well-location and completion data were willingly provided by the following water-well drillers and drilling firms who have worked in the area: Messrs. Lloyd and Ralph Cotton, Jack Gill, Jr., Neil Lumpkin, "Red" Martin, Jerry McGehee, Essley Stafford, D. K. Summers, Sr., Dorman Varnado, and Anthony Woodward; Mr. Thad Shows of Griner Drilling Service; Layne-Louisiana Co.; and Summers Brothers Water Well Drilling Contractors.

Well owners throughout Washington Parish were especially gracious and helpful in permitting access to their wells for water-level measurements and water sampling.

GENERAL GEOLOGY AND AQUIFER FRAMEWORK

Fresh ground water occurs in deposits ranging from Holocene to Miocene age in Washington Parish. Deposits of Holocene age include the unconsolidated sands, gravels, and clays underlying the flood plains of major streams. Unconsolidated Pleistocene and Pliocene sands and clays crop out along ridges and river valleys throughout the parish. These terrace remnants are recharged readily and are a source of recharge to underlying aquifers. It should be emphasized that, hydraulically, the time and lithologic boundaries between Holocene, Pleistocene, and underlying Pliocene sands are not significant.

Unconsolidated Pliocene sands and gravels crop out over much of the parish and are difficult to distinguish from overlying Pleistocene and from underlying Miocene sediments on the basis of geophysical or typical drillers' logs. These deposits also act as a valuable recharge medium.

The lithologic and time boundaries for the undifferentiated Pliocene and Miocene deposits that underlie the entire parish are virtually indistinguishable; thus, the time assignation is Pliocene and Miocene undifferentiated.

The Miocene deposits in Washington Parish also underlie the entire area. These sediments consist predominantly of unconsolidated, interbedded sands and clays; some thin limestone beds (in the freshwater section) occur in the northeast section of the parish.

The two major structures influencing the geology of Washington Parish are the southern Mississippi uplift and the gulf coast geosyncline (Fisk, 1944, p. 64-67). These features cause sediments throughout the parish to dip generally to the southwest at angles ranging from a few feet per mile for the shallow sediments to 80 ft/mi for the deeper sediments in the southwest section of the parish. No faulting has been mapped or observed in the freshwater section in Washington Parish.

Aquifers in Washington Parish are correlated, where practical, with aquifers cited in reports describing adjacent parishes and counties. Correlations between aquifers, not geologic formations or time, are emphasized in this report. Correlations of aquifers in Washington Parish are shown in the geohydrologic sections on plates 2, 3, 4, and 5.

The major difficulty in correlating individual sand units in southeastern Louisiana is the lenticularity of the deposits. Abrupt lateral changes from sand to clay make long-distance correlations uncertain. The correlation problems created by the multilayered lenticular sand and gravel aquifers in Washington Parish have been minimized in this report by (a) correlating individual sand and gravel beds only in areas where control is adequate and (b) grouping sand and gravel units in aquifer "zones" similar to the Pliocene and Miocene zones (aquifer systems) described by Morgan (1963, p. 16-20) in areas with little control. The aquifer zones applicable to Washington Parish and noted on plates 2, 3, and 5 are correlatable to the aquifer zones of Morgan (1963, p. 16-20) and Nyman and Fayard (1978, p. 7). Deposits of Pliocene age are assigned to hydraulic zone 1; Pliocene and Miocene deposits, undifferentiated, are assigned to hydraulic zone 2; deposits of Miocene age are assigned to hydraulic zone 3.

General features of the parishwide aquifer system will be discussed in the following section. This section will be followed by detailed discussions of the aquifers in the Bogalusa and Franklinton areas, respectively.

PARISHWIDE GROUND-WATER SYSTEM

Study of the vertical and lateral distribution of sands and the variations of the base of freshwater provides a fundamental understanding of the ground-water resources of Washington Parish. Although few data on aquifer characteristics and water quality are available for the central sections of the parish, the correlations on plates 2, 3, 4, and 5 and inferences from data in the Bogalusa and Franklinton areas provide a basis for general appraisals.

As most of the wells in the parish, except at Bogalusa and Franklinton, are screened in the "shallow aquifer," this report emphasizes the distribution, aquifer characteristics, water levels, and water quality of the shallow aquifer system in Washington Parish.

Sand Distribution

A map showing the number and aggregate thickness of freshwater-bearing sands in the parish is presented on plate 6. The contour lines are based upon sand thicknesses determined from geophysical logs. Only those that begin near land surface and extend through the base of freshwater were used. Only those aquifers 25 ft or more thick were considered, and a clay interval of 25 ft or more between sands was used to differentiate between aquifers.

The greatest thickness of sand is in the south-central part of the parish. The aggregate sand thickness generally thins toward the southwest from Varnado and toward the southeast from Mt. Hermon to Stoney Point. From the point of maximum mapped thickness, the aggregate freshwater-bearing sand thickness decreases approximately 900 ft toward Franklinton and approximately 600 ft toward Bogalusa. Plate 6 also shows that between 9 and 15 freshwater-bearing aquifers 25 ft or more thick are available throughout the parish.

The percentage of sand in the freshwater-bearing column closely follows the pattern of the aggregate thickness. Percentages range from a maximum of 60 percent approximately 3.5 mi northwest of Enon to approximately 35 percent at Franklinton. Sand percentages were calculated only for those wells with geophysical logs starting near the surface and extending through the base of freshwater.

Base of Freshwater

The altitude, with reference to the National Geodetic Vertical Datum of 1929 (NGVD), formerly called mean sea level, of the deepest occurrence of fresh ground water is referred to as the base of freshwater. (See pl. 7.) At any given site the altitude of the base of freshwater can be added to the elevation of land surface to calculate the maximum depth (from land surface) of occurrence of fresh ground water. In this report, ground water is considered to be fresh if its chloride concentration is less than 250 mg/L. (This is roughly equivalent to 1,000 mg/L dissolved solids, the general limit for freshwater set by the U.S. Environmental Protection Agency, 1976.) Chloride concentrations were estimated from geophysical logs, using the methods described by Turcan (1966). Plate 7 shows the base of fresh ground water generally increasing in depth from the northeast corner of the parish to the south-southwest. Altitudes range from less than 1,900 ft below NGVD in the northeast to more than 3,300 ft below NGVD 5 mi west of Rio. A trough, where the base of freshwater ranges from 3,320 to 2,920 ft below NGVD, extends from an area 5 mi west of Rio to the west-northwest near Stoney Point. This trough may represent the southern limit of freshwater flushing in the deeper sands. The distinct lobes formed by the contours in the central section of the parish probably reflect the areal differences in the lithology that control flushing of the sediments.

Shallow Aquifer System

Extent, Lithology, and Thickness

The shallow aquifer system, which underlies the entire parish, is composed of sands and gravels underlying upland terraces and younger alluvial-plain deposits in the major river valleys. The shallow aquifer system in Washington Parish can be correlated with the shallow aquifer system described by Nyman and Fayard (1978, p. 13-19). It can also be correlated with shallow sands, gravels, and clays comprising sections of the Citronelle and Graham Ferry Formations of Pliocene age in Walthall and Pearl River Counties, Miss. In the Bogalusa area, the shallow aquifer is known as the "100-foot" sand. Thicknesses range from less than 50 ft to more than 400 ft in sections of the Pearl River and Bogue Chitto basins. The geologic sections (pls. 2, 3, and 5) illustrate the thickness variations.

Well Yields and Aquifer Characteristics

The largest reported yield from a well tapping the shallow aquifer in Washington Parish is 2,960 gal/min from a 22-inch industrial well

(Wa-6) in Bogalusa. (Other large-capacity industrial wells, yields greater than 1,000 gal/min, in Bogalusa will be discussed later.) Outside of the Bogalusa and Franklinton areas, the highest reported yield from the shallow aquifer is 500 gal/min from an 8-inch irrigation well (Wa-104) at the Louisiana State University Southeast Louisiana Experimental Station. Most of the wells in the shallow aquifer in Washington Parish are domestic wells with low yields. Completion data for selected wells in Washington Parish are included in table 2.

Transmissivities determined from pumping tests ranged from 14,700 ft^2/d, or 110,000 (gal/d)/ft, at well Wa-102 to 9,380 ft^2/d, or 70,000 (gal/d)/ft, at well Wa-61D in Angie. Hydraulic conductivities ranged from 100 to 200 ft/d, or 750 to 1,500 $(gal/d)/ft^2$. Storage coefficients for two industrial wells in Bogalusa (Wa-42 and Wa-13) were 1×10^{-3} and 1.8×10^{-3}, respectively.

Water Levels and Water Use

Water levels in the shallow aquifer system are governed by topography, precipitation (intensity, duration, and time of year), evapotranspiration, and pumpage. During the summer months the effects of evapotranspiration probably override precipitation.

A map showing the generalized configuration of the potentiometric surface of the shallow aquifer in October 1976 is presented in figure 1. The altitude of the water-level surface ranged from 265 to 75 ft NGVD. The effects of drainage on the general configuration are significant; pumping in the Bogalusa area does not cause a regional effect because of recharge from the Pearl River. The effect of the Pearl River on the "100-foot" sand in the Bogalusa area is discussed later.

Water-level trends in the shallow aquifer are represented by the hydrographs for observation wells Wa-13 and Wa-103 (fig. 2). Although short-term fluctuations in well Wa-13 are probably caused by stage variations in the Pearl River (discussed later), the hydrograph indicates a long-term rising trend of about 1 ft/yr since 1965. The short-term hydrograph for well Wa-103 (which is not influenced by nearby streams and is more typical of the shallow aquifer in the upland areas) shows no significant trend for the 2½ years of record.

The shallow aquifer contributes about one-third of all ground water used in Washington Parish. This contribution, estimated at approximately 10.5 Mgal/d in 1974, includes 6.8 Mgal/d used by industry in Bogalusa. Although industrial use accounts for most of the ground water pumped, the shallow aquifer is the principal source of water for the parish's domestic wells. Furthermore, in 1974, about 37 percent of the total parish population (the entire rural parish population) relied on water from the shallow aquifer system.

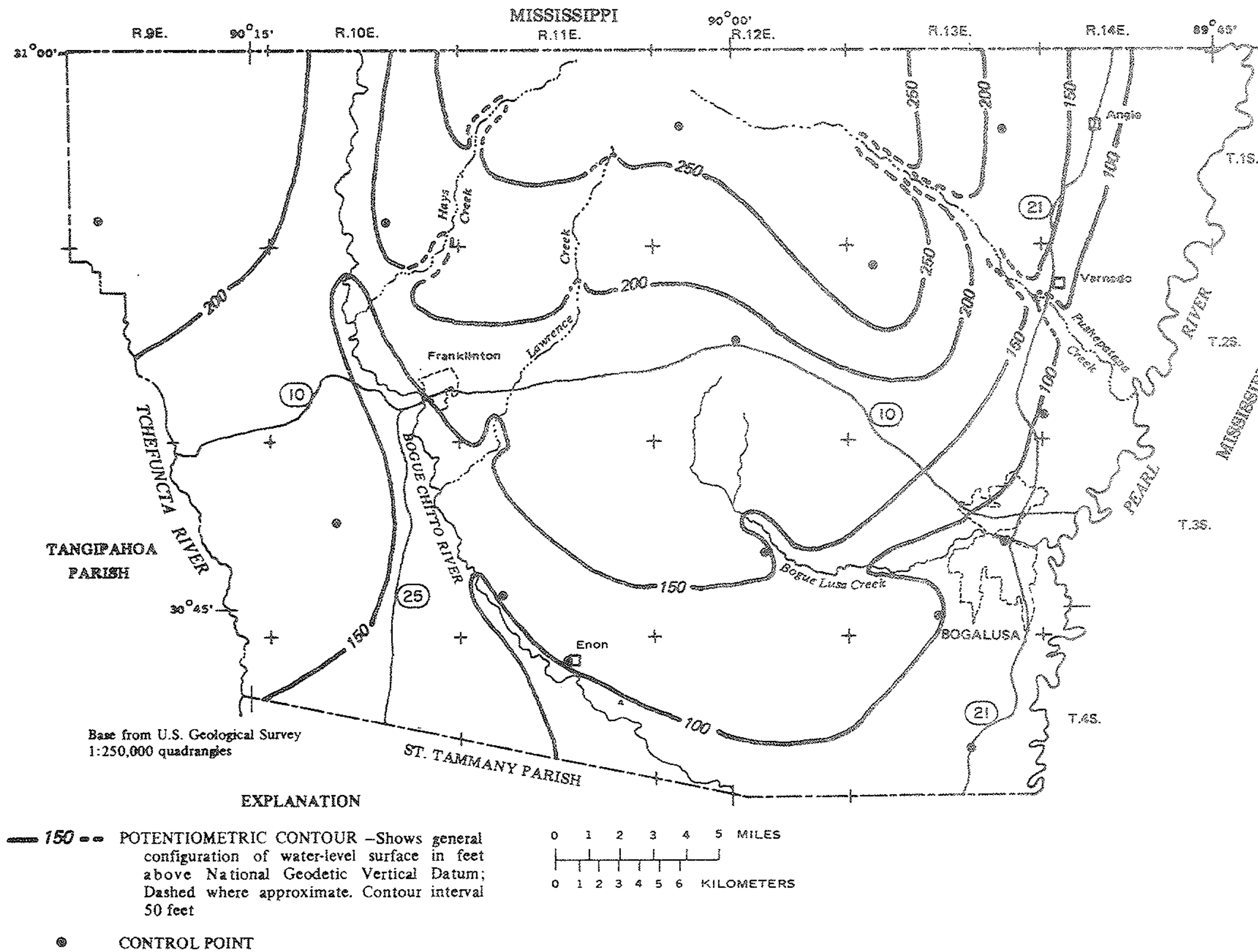

Figure 1.--General configuration of the water-level surface of the shallow aquifer in Washington Parish, October 1976.

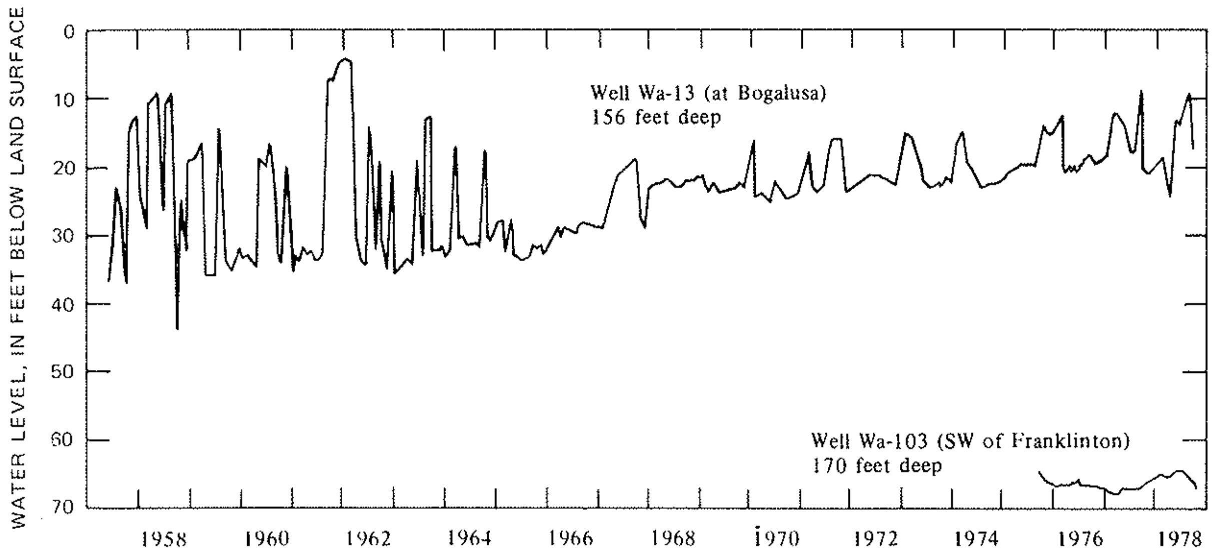

Figure 2.--Hydrographs for wells in the shallow aquifer.

Water Quality

Water from the shallow aquifer system is generally low in mineral content; the dissolved-solids concentration in water from wells sampled ranges from 21 to 119 mg/L. Although iron concentrations range from 0.0 to 2.2 mg/L, concentrations of less than 0.2 mg/L are common. Manganese concentrations range from 0.0 to 0.08 mg/L. As the pH is generally less than 6.0 units (table 3), water from the shallow aquifer system in Washington Parish is corrosive to metals.

BOGALUSA AREA

Eight major aquifers have been identified in the Bogalusa area. Major aquifers with some development are the "100-foot," "1,300-foot," and "1,500-foot" sands; Ramsay; and "2,200-foot" sand. Aquifers with little or no development are the "600-foot," "700-foot," and "2,400-foot" sands. These aquifers are named with reference to approximate depth below land surface in the vicinity of well Wa-58A near the center of Bogalusa. The names are intended for local use; correlations with aquifers in other areas, where possible, are included. A northward-trending geohydrologic section through Bogalusa is shown on plate 4.

"100-Foot" Sand of the Bogalusa Area

Extent, Lithology, and Thickness

In the Bogalusa area the shallow aquifer of Washington Parish is known as the "100-foot" sand. The aquifer, consisting of predominantly medium to coarse sand and gravel, is found throughout the Bogalusa area. Shallow sands and gravels in the Pearl River alluvium, in the immediate Bogalusa area, merge with and are included in the "100-foot" sand. Thicknesses of the "100-foot" sand range from about 25 ft in the city's northern uplands to more than 125 ft in the east-central section of the city. Depths of wells in this sand range from less than 50 ft to more than 170 ft below land surface.

Well Yields and Aquifer Characteristics

The largest reported yield from a well tapping the "100-foot" sand of the Bogalusa area was 2,960 gal/min from a 22-inch industrial well (Wa-6) in 1935. Other industrial wells in the "100-foot" sand are currently capable of yielding in excess of 1,000 gal/min.

Transmissivities calculated from pumping tests of two wells (Wa-42 and Wa-13) in the "100-foot" sand are 10,000 and 10,600 ft^2/d, or 75,000 and 79,000 (gal/d)/ft; hydraulic conductivities are 100 and 113 ft/d, or 750 and 840 $(gal/d)/ft^2$; and storage coefficients are $1x10^{-3}$ and $1.8x10^{-3}$, respectively.

Water Levels and Water Use

Since 1967, water levels in the "100-foot" sand near the center of Bogalusa have been recovering slightly at a rate of about 0.6 ft/yr. (See fig. 3.) This long-term trend is due to an increased reliance on deeper aquifers by the Crown Zellerbach plant in Bogalusa.

Seasonal highs and lows can be related to stages of the Pearl River near Bogalusa. (See fig. 3.) The main channel of the Pearl River is less than 1.5 mi from well Wa-13 (at the Crown Zellerbach plant).

Industry is the principal user of water from the "100-foot" sand of the Bogalusa area. Approximately 23 percent (about 6 Mgal/d) of the ground water used in the Bogalusa area and 19 percent of the ground water used in Washington Parish was pumped from the "100-foot" sand in 1974 (three wells).

Water Quality

Ground water in the "100-foot" sand of the Bogalusa area generally has a low mineral content, low iron and manganese concentrations, and a low pH. Dissolved-solids concentrations in water from wells Wa-42 and Wa-54 were 99 and 119 mg/L, respectively. The dissolved iron concentration from well Wa-42 was 0.04 mg/L, and dissolved manganese concentrations from wells Wa-42 and Wa-54 were 0.05 and 0.08 mg/L, respectively. (See pl. 1 for location.) The pH of water from these wells was 5.5 and 5.7 units, respectively. Although low in dissolved iron and manganese,

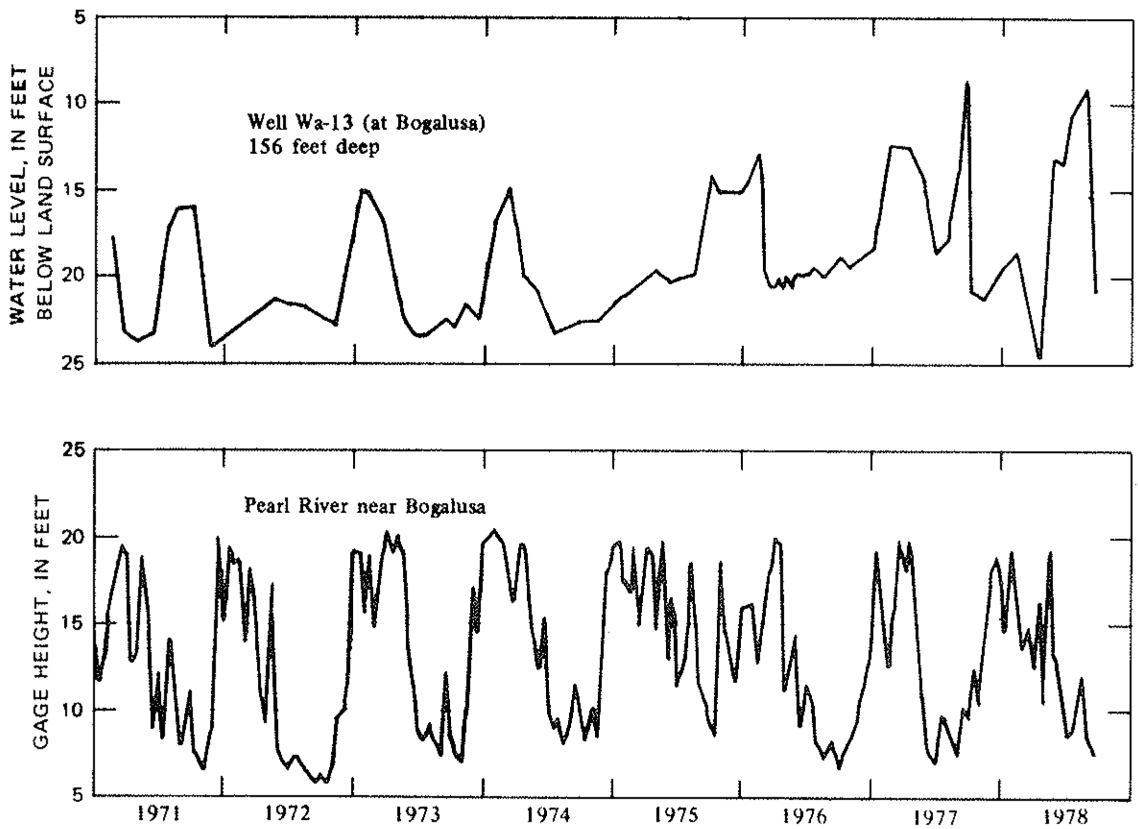

Figure 3.--Effects of Pearl River stage on water levels in an observation well tapping the "100-foot" sand of the Bogalusa area.

this water is corrosive and may require treatment or use of specific, non-corrosive equipment for some uses. Chemical analyses of water from the "100-foot" sand are given in table 3 (wells Wa-42 and Wa-54).

"600-Foot" Sand of the Bogalusa Area

The "600-foot" sand underlies most of the Bogalusa area. Thickness of this predominantly fine to medium sand increases from 0 ft in the north section of the city (well Wa-93) to about 100 ft near the center of the city (well Wa-58A) and merges with the "700-foot" sand in the southern part of the city, where the combined thickness is about 370 ft (well Wa-92).

A yield of 2,000 gal/min was reported from a 24-inch industrial well (Wa-7) in 1941. No large-capacity wells are currently completed in the "600-foot" sand. Data on aquifer characteristics or current water levels are not available for this sand. In 1970, however, water levels in well

Wa-7 (completed in the "600-foot" sand) were approximately at land surface (about 100 ft NGVD). This level was more than 23 ft lower than the water level in the "700-foot" sand.

Water from the "600-foot" sand of the Bogalusa area can be expected to contain high iron concentrations. An analysis from well Wa-7 indicated a total iron concentration of 1.9 mg/L; manganese was 0.02 mg/L, and pH was 6.0 units. Concentrations of dissolved solids and chloride were 93 and 3.8 mg/L, respectively, and hardness was 16 mg/L.

"700-Foot" Sand of the Bogalusa Area

Extent, Lithology, and Thickness

The "700-foot" sand extends throughout the Bogalusa area. Depths from land surface to the top of this aquifer range from 570 ft at well Wa-93 (north edge of Bogalusa) to 900 ft at well Wa-65B. The "700-foot" sand can be correlated with the Covington aquifer identified by Nyman and Fayard (1978). This fine- to coarse-grained sand (predominantly fine at well Wa-56) ranges in thickness from 90 ft in the northern part of the city (well Wa-93) to approximately 370 ft at well Wa-92 where the "600-foot" and "700-foot" sands merge. (See pl. 4.) South of well Wa-92, the merged "600-foot" and "700-foot" sands split into thinner sands.

Well Yields and Aquifer Characteristics

The highest reported yield from a well completed in the "700-foot" sand of the Bogalusa area was 2,520 gal/min from a 20-inch industrial well (Wa-5). Yields in excess of 1,000 gal/min from several industrial and public-supply wells in the "700-foot" sand have been reported.

An aquifer test using well Wa-49 indicates a transmissivity of 12,600 ft^2/d, or 94,000 (gal/d)/ft, and a hydraulic conductivity of 125 ft/d, or 940 $(gal/d)/ft^2$. A storage coefficient of 4.5×10^{-4} was also calculated from data from this test.

Water Levels and Water Use

Water levels in the "700-foot" sand have been declining at the low rate of approximately 0.2 to 0.4 ft/yr since 1971. The hydrograph for well Wa-15 (an unused former public-supply well) shows a slight declining trend of 0.7 ft/yr. (See fig. 4.) Probable causes for this decline include head losses from a combination of (a) wastage of water from uncapped, flowing wells and (b) leakage through corroded well casings and leaky couplings (and possibly also through the annular space outside the well) to shallower aquifers with lower hydraulic heads. The recovery during 1968-69 is probably due to the abandonment of well Wa-49 in 1969.

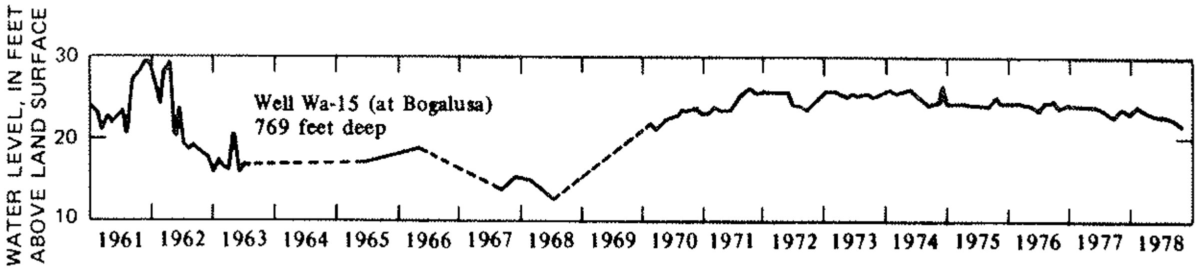

Figure 4.--Hydrograph for the "700-foot" sand of the Bogalusa area.

A public-supply well (Wa-14) is the only known large-capacity well currently with a potential for using water from the "700-foot" sand of the Bogalusa area. This well is on standby status and is pumped only during emergencies and periodic maintenance. However, some discharge from the aquifer is probably accounted for by flow from uncapped wells and leakage from old, improperly abandoned wells. In the past, pumpage from wells in the "700-foot" sand was much larger. For example, in 1965, pumpage from industrial wells Wa-39 and Wa-49 was about 3.6 Mgal/d.

Water Quality

A major reason for the decline in pumpage from the "700-foot" sand is the high iron concentration in the water. Chemical analyses of water samples from wells completed in the "700-foot" sand indicate iron concentrations ranging from 0.86 to 2.7 mg/L. Manganese concentrations range from 0.04 to 0.18 mg/L, and pH from 6.2 to 7.3 units. The dissolved-solids concentration in all samples was less than 123 mg/L, chloride concentration was less than 4.0 mg/L, and the maximum hardness was 19 mg/L.

"1,300-Foot" Sand of the Bogalusa Area

Extent, Lithology, and Thickness

The "1,300-foot" sand is found throughout the Bogalusa area and can be correlated with the Amite aquifer (Nyman and Fayard, 1978). A mechanical analysis of sand collected from the 1,311- to 1,356-foot interval at well Wa-56 (near the center of the city) indicates predominantly fine to medium sand. Predominantly fine sand was found in the 1,110- to 1,173-foot interval at well Wa-124 (approximately 1 mi north of Bogalusa). Depths to the top of the aquifer from land surface range from 1,200 ft at well Wa-92 to 1,465 ft at well Wa-65B. Thicknesses of 60 to 100 ft within the city are common.

Well Yields and Aquifer Characteristics

Only two large-capacity wells are currently using water from the "1,300-foot" sand. A third well, at the site of well Wa-124, is scheduled to become operable in 1978. The highest reported yield, 1,650 gal/min, was from an industrial well (Wa-56) in 1958. Well Wa-44, an 18-inch public-supply well, reportedly flowed 650 gal/min in 1951.

No aquifer tests have been made in wells in the "1,300-foot" sand of the Bogalusa area. However, the transmissivity of this sand can be estimated from the specific capacity, 31 (gal/d)/ft, of well Wa-44 using the method described by Meyer (1963, p. 338-340). (Friction loss is negligible, the entire aquifer is screened, and the well is considered to be efficient.) Assuming a storage coefficient between 0.0001 and 0.001, an approximate transmissivity ranging from 11,000 to 12,000 ft^2/d, or 80,000 to 90,000 (gal/d)/ft, can be estimated. Estimating an aquifer thickness of 125 ft, the hydraulic conductivity should range between 86 and 96 ft/d, or 640 and 720 $(gal/d)/ft^2$.

Water Levels and Water Use

No continuous long-term water-level records are available for wells completed in the "1,300-foot" sand. The water level in well Wa-44 was reported to be 21 ft above land surface in June 1951. The level in the well was 52.48 ft below land surface on May 26, 1977. This decline is compatable with water-level declines in the Amite aquifer (Nyman and Fayard, 1978, p. 56-57). Probable causes of the water-level decline in the "1,300-foot" sand include sustained pumpage by industry and the city of Bogalusa and effects of pumpage from the Amite aquifer to the west.

The "1,300-foot" sand is a relatively little-used source of water in the Bogalusa area. In 1974, only about 8.3 percent (2.2 Mgal/d) of the total pumpage by city and industry in Bogalusa was from this sand. The "1,300-foot" sand produces approximately 11 percent of the Bogalusa municipal pumpage, and about 7 percent of the total parish pumpage.

Water Quality

Water from the "1,300-foot" sand is generally of excellent quality in the Bogalusa area. Iron concentrations in water samples from two wells (Wa-56 and Wa-124B) were 0.0 and 0.01 mg/L, respectively. Manganese was 0.0 and 0.02 mg/L, respectively, and pH values were 8.6 and 8.8 units, respectively. Concentrations of dissolved solids were 180 and 166 mg/L, respectively, and hardness was less than 4 mg/L in samples from both wells.

"1,500-Foot" Sand of the Bogalusa Area

Extent, Lithology, and Thickness

The "1,500-foot" sand is present beneath most of the Bogalusa area. The aquifer is continuous to the north and west of the city (pls. 2 and 3) and probably merges to the east with a thicker sand shown by an oil-test geophysical log about 8 mi east of the city. The "1,500-foot" sand of the Bogalusa area is probably equivalent to a lower unit of the Amite aquifer described by Nyman and Fayard (1978, p. 54-60). The aquifer has a maximum thickness of about 125 ft in the north section of the city but thins and pinches out in the south section. (The "1,500-foot" sand is absent at wells Wa-66 and Wa-65.) Mechanical analyses from "1,500-foot" sand intervals in five wells (Wa-124, Wa-93, Wa-92, Wa-56, and Wa-55) indicate that the "1,500-foot" sand is predominantly medium grained.

Well Yields and Aquifer Characteristics

The highest reported yield from a well completed in the "1,500-foot" sand of the Bogalusa area is 2,260 gal/min from a 16-inch public-supply well (Wa-93). Yields of 1,000 gal/min from other public-supply wells tapping this aquifer are common.

Aquifer tests of the "1,500-foot" sand using wells Wa-55 and Wa-93 indicate a transmissivity of 5,890 and 14,100 ft^2/d, or 44,000 and 105,000 (gal/d)/ft, respectively. Hydraulic conductivities were 67 and 125 ft/d, or 500 and 940 $(gal/d)/ft^2$, respectively. Uncorrected specific capacities in well Wa-93 were 29 and 27 (gal/min)/ft at pumping rates of 1,200 to 2,260 gal/min, respectively.

Water Levels and Water Use

Since 1968, the water level in well Wa-41 (screened in the "1,500-foot" sand) has declined at an average rate of about 2.5 ft/yr. Since 1975, however, the rate of decline has increased to 4-5 ft/yr. (See fig. 5.) This increase in the rate of decline is probably due to the additional pumpage from two new public-supply wells (drilled in 1974) that are completed in the "1,500-foot" sand. The sharp decline in 1957 was probably caused by pumpage from wells Wa-53 and Wa-55 (drilled in 1956 and 1957, respectively).

The "1,500-foot" sand is the major source of public water supply in the Bogalusa area. In 1974, approximately 89 percent of the pumpage by the city of Bogalusa was from this aquifer. The "1,500-foot" sand also contributed about 30 percent (7.9 Mgal/d) of all ground-water pumpage in the Bogalusa area, and about 25 percent of the ground water used in Washington Parish in 1974. This pumpage was produced by one industrial and six public-supply wells.

Water Quality

Water from the "1,500-foot" sand in the Bogalusa area is excellent for public-supply use. Dissolved iron and manganese concentrations are generally less than 0.1 and 0.01 mg/L, respectively. The pH of water

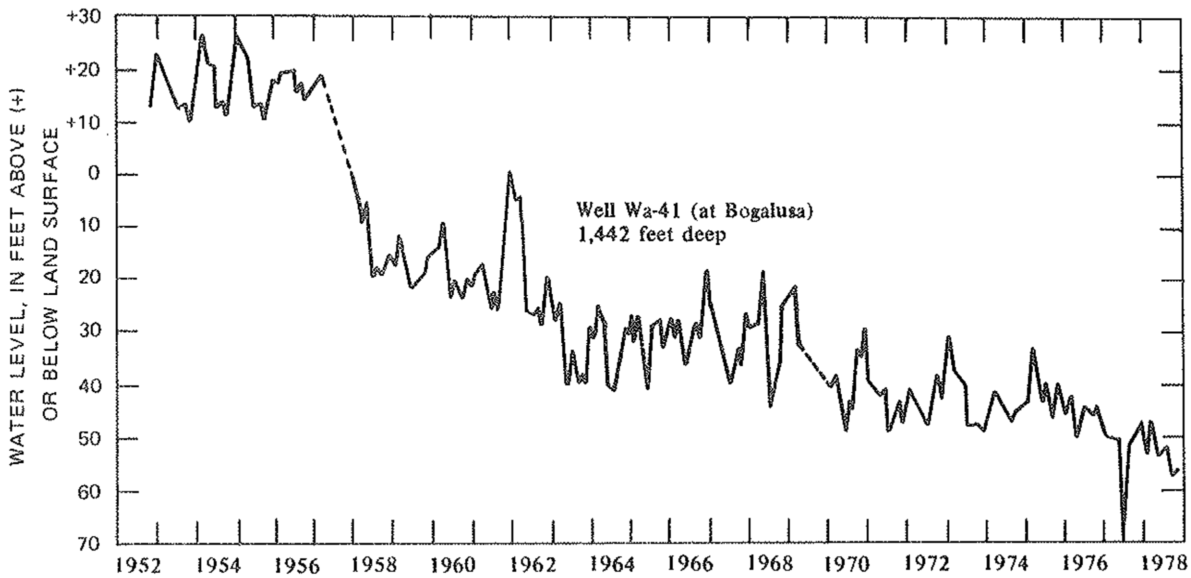

Figure 5.--Hydrograph for the "1,500-foot" sand of the Bogalusa area.

from five samples ranges from 7.4 to 8.5 units, and dissolved-solids concentrations range from 146 to 170 mg/L. Dissolved chloride and hardness concentrations are generally less than 7 and 1 mg/L, respectively.

Ramsay Aquifer

Extent, Lithology, and Thickness

The Ramsay aquifer, an important potential source of fresh ground water identified by Nyman and Fayard (1978, p. 58-60) in Tangipahoa and St. Tammany Parishes, also occurs in the Bogalusa area. Depths to the top of the medium- to coarse-grained aquifer range from 1,850 to 2,035 ft below land surface at wells Wa-58A and Wa-65, respectively. The aquifer dips to the southwest at a rate of about 60 to 70 ft/mi in the Bogalusa area. Analysis of geophysical logs indicates that the Ramsay aquifer thickens in all directions from Bogalusa; thicknesses (from geophysical logs) in the Bogalusa area range from 240 ft to more than 270 ft.

Well Yields and Aquifer Characteristics

The only reported large-capacity well currently screened in the Ramsay aquifer in the Bogalusa area is well Wa-81. This 22-inch industrial well reportedly yielded 2,900 gal/min in 1970.

No data on aquifer characteristics are available for the Ramsay aquifer in the Bogalusa area. Based on grain-size and thickness data from wells Wa-124 and Wa-58A, the hydraulic conductivity estimate of

214 ft/d, or 1,600 (gal/d)/ft^2, by Nyman and Fayard (1978, p. 58) for a well in St. Tammany Parish is probably applicable for the Bogalusa area. Assuming an aquifer thickness of about 250 ft, a transmissivity of about 42,900 ft^2/d, or 320,000 (gal/d)/ft, can be estimated for the Ramsay aquifer in the Bogalusa area.

Water Levels and Water Use

No water-level data are available for the Ramsay aquifer in the Bogalusa area. Free flow at well Wa-81 (land-surface altitude of about 85 ft NGVD) shows that the potentiometric surface of the aquifer is above land surface at this location.

Water use from the Ramsay aquifer in the Bogalusa area (well Wa-81) was about 3.0 Mgal/d in 1974. This represents about 11 percent of the pumpage in the Bogalusa area, and about 9 percent of the 1974 pumpage in Washington Parish.

Water Quality

A major reason for the lack of development of the Ramsay aquifer in the Bogalusa area is the high iron concentration in the water. An analysis of water from well Wa-81 indicates that dissolved iron and manganese occur in concentrations of 1.0 and 0.10 mg/L, respectively. Both of these values exceed the recommended limits by the U.S. Environmental Protection Agency (1977). Dissolved solids and chloride are 113 and 2.6 mg/L, respectively. The pH is 6.7 units, and hardness is 5 mg/L.

"2,200-Foot" Sand of the Bogalusa Area

Extent, Lithology, and Thickness

The predominantly fine- to medium-grained "2,200-foot" sand is probably present beneath the entire Bogalusa area. Wells penetrate this sand at only one site in the city; however, geophysical logs from well Wa-124, several miles north of Bogalusa, and oil-test wells approximately 7 mi west of Bogalusa (pl. 3, serial No. 27729) and approximately 7 mi east of Bogalusa (pl. 3, Mississippi serial No. 1E-48071) indicate that the "2,200-foot" sand is continuous in these directions. No information for this sand is available south of the city. Depths to the top of the "2,200-foot" sand (from land surface) range from 2,020 ft at well Wa-124 (north of Bogalusa) to 2,140 ft at well Wa-58A. Thicknesses range from 70 ft at well Wa-124 to 150 ft near the center of the city (well Wa-58A).

Well Yields and Aquifer Characteristics

A 20-inch industrial well (Wa-59) completed in the "2,200-foot" sand produced 2,500 gal/min in 1964. Other industrial wells tapping this sand are capable of pumping at a sustained rate of greater than 1,600 gal/min.

No reliable results of aquifer tests on the "2,200-foot" sand are available. The transmissivity of the "2,200-foot" sand at well Wa-59, however, can be approximated by using the method described by Meyer (1963, p. 338-340). Assuming a storage coefficient between 0.0001 and 0.001, and using a corrected specific capacity of 31.0 (gal/min)/ft, a transmissivity of about 10,700 ft^2/d, or 80,000 (gal/d)/ft, can be estimated. This transmissivity suggests a hydraulic conductivity of about 74 ft/d, or 550 (gal/d)/ft^2.

Water Levels and Water Use

No long-term water-level records are available for wells completed in the "2,200-foot" sand in the Bogalusa area. Initial water levels measured in wells Wa-59 (1964) and Wa-82 (1970) were 18 ft above and 25.70 ft below land surface, respectively. (The latter measurement was made with two nearby wells pumping.) In March 1975, water-level measurements in wells Wa-82 and Wa-59 indicated a potentiometric surface of about 90 ft NGVD. These wells were measured while well Wa-58B, less than 800 ft from well Wa-82, was pumping at a rate of more than 1,600 gal/min. The March 1975 water level in well Wa-59 was about 23 ft lower than the June 1964 water level.

The "2,200-foot" sand is the second most heavily pumped aquifer in the Bogalusa area. In 1974, this sand contributed approximately 7.4 Mgal/d, or 28 percent, of all ground water pumped in the Bogalusa area. This figure represents about 24 percent of the 1974 ground-water usage in Washington Parish. To date, all water pumped from this sand is used by industry.

Water Quality

The quality of water in the "2,200-foot" sand in the Bogalusa area is relatively good, although the iron concentration is variable. Dissolved iron and manganese concentrations in water from three wells (Wa-58B, Wa-59, and Wa-124A) range from 0.04 to 1.00 and 0.04 to 0.11 mg/L, respectively. The pH ranges from 7.0 to 8.1 units, and dissolved solids are generally about 146 mg/L. Dissolved chloride and hardness are generally less than 3 mg/L. Water with the highest iron concentration is from the northernmost well; water with the lowest iron concentration is from the southernmost well. These results indicate that the water with the lowest iron concentrations probably can be found in the central and south sections of the city.

"2,400-Foot" Sand of the Bogalusa Area

A major undeveloped aquifer in the Bogalusa area is the "2,400-foot" sand. This sand correlates with the Franklinton aquifer (see section on "Franklinton area") described by Nyman and Fayard (1978, p. 60-63). The aquifer is about 60 ft thick at well Wa-124; the top of the sand is about 2,220 ft below land surface. The "2,400-foot" sand is about 65 ft thick 7 mi west of Bogalusa, La., (pl. 3, oil-test well, serial No. 27729) and about 180 ft thick at approximately 7 mi east of Bogalusa (pl. 3, oil-test well, Mississippi serial No. 1E-48071).

Aquifer-characteristic or water-level data are not available for this aquifer in the Bogalusa area. There are no known wells completed in the "2,400-foot" sand in the Bogalusa area. More data for this aquifer are needed before its potential can be reasonably evaluated.

FRANKLINTON AREA

The detailed discussion of aquifers in the Franklinton area will be limited to the Kentwood, Tchefuncta, Ramsay, and Franklinton aquifers. These aquifers correlate with aquifers of the same name described by Nyman and Fayard (1978, p. 30-33, 46-49, and 60-62).

Kentwood Aquifer

Extent, Lithology, and Thickness

The Kentwood aquifer is present throughout the Franklinton area. Depth to the top of the predominantly medium- to fine-grained sand ranges from 490 ft below land surface at well Wa-89 to 675 ft below land surface at well Wa-88. (See pl. 1 for location.) Aquifer thickness increases to the west, east, and south of the Franklinton area. At Franklinton the thickness ranges from 60 ft at well Wa-88 to 140 ft at well Wa-57.

Well Yields and Aquifer Characteristics

There are no large-capacity wells reported to be completed in the Kentwood aquifer in the Franklinton area. The largest reported yield in this area was 400 gal/min from a 6-inch public-supply well (Wa-18) in 1949.

Based on grain size and corrected specific capacity, the estimated transmissivity of the Kentwood aquifer in this area is probably between 10,700 and 13,400 ft^2/d, or 80,000 and 100,000 (gal/d)/ft; the hydraulic conductivity at well Wa-18 is probably between 80 and 100 ft/d, or 600 and 750 $(gal/d)/ft^2$.

Water Levels and Water Use

Water-level changes in the Kentwood aquifer in the Franklinton area are typified by the hydrograph of well Wa-18 (fig. 6). Nyman and Fayard (1978, p. 32-33) attribute the significant rise in 1959 to a shift in pumpage from the Kentwood aquifer to a new, deeper well drilled by the town of Franklinton. The hydrograph also shows a slight, declining trend (less than 0.25 ft/yr) since 1966. This trend can be attributed to regional withdrawals and discharges from numerous controlled and uncontrolled flowing wells in the Bogue Chitto flood plain.

No public-supply or industrial wells in the Franklinton area currently use water from the Kentwood aquifer. Water losses from flowing wells along the Bogue Chitto near Franklinton probably approach 0.2 Mgal/d.

Water Quality

The quality of water from the Kentwood aquifer in the Franklinton area corresponds to the general quality of the water described by Nyman and Fayard (1978, p. 33). Iron and manganese concentrations in a water sample collected in 1977 from well Wa-18 are 0.16 and 0.08 mg/L, respectively. Dissolved solids are 104 mg/L, hardness is 18 mg/L, and dissolved chloride is less than 3 mg/L. The pH of 6.2 units indicates that the water may be corrosive.

Tchefuncta Aquifer

Extent, Lithology, and Thickness

The Tchefuncta aquifer occurs throughout the Franklinton area. Depths to the top of the predominantly medium- to fine-grained sand range from 880 ft at well Wa-57 to 955 ft at well Wa-37. The Tchefuncta aquifer thins and contains more clay to the west, east, and north of the Franklinton area. Total thickness of the Tchefuncta aquifer at well Wa-89 is 200 ft; however, the net sand thickness is only 130 ft. Elsewhere in the Franklinton area the thickness of the aquifer ranges from 90 to 180 ft at wells Wa-88 and Wa-57, respectively.

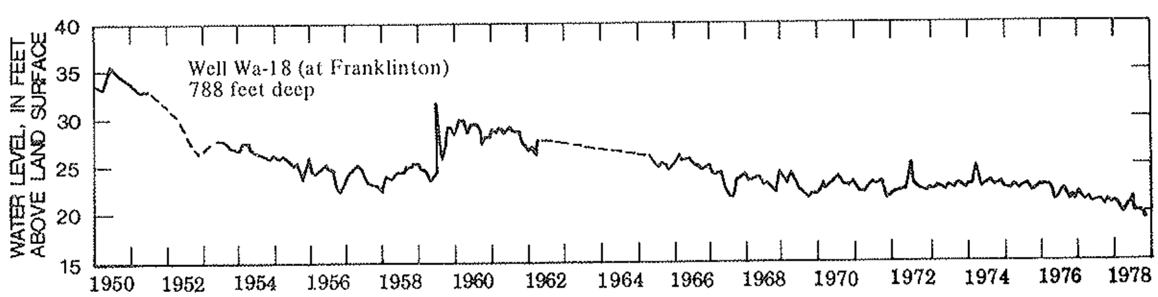

Figure 6.--Hydrograph for the Kentwood aquifer in the Franklinton area.

Well Yields and Aquifer Characteristics

In the Franklinton area, no large-capacity wells completed in the Tchefuncta aquifer have been reported. Nyman and Fayard (1978, p. 46) report yields of 980 and 1,500 gal/min from wells tapping the Tchefuncta aquifer near Covington and Hammond, respectively. Grain size and thickness of sand in the Tchefuncta aquifer at well Wa-57 are similar to that in the well at Hammond cited by Nyman and Fayard. They estimate the transmissivity and hydraulic conductivity of the aquifer at Hammond to be 8,040 ft^2/d, or 60,000 (gal/d)/ft, and 67 ft/d, or 500 (gal/d)/ft^2, respectively. These values probably represent a conservative estimate for the Tchefuncta aquifer in the Franklinton area.

Water Levels and Water Use

No long-term water-level trends for the Tchefuncta aquifer in the Franklinton area are available. The water level in well Wa-108, about 1 mi northwest of Franklinton, was about 23 ft above land surface in May 1977. A comparison of water-level measurements made 1975-77 (table 1) indicates a declining rate of about 1 ft/yr.

Pumpage from the Tchefuncta aquifer in the Franklinton area is insignificant, and no significant water wastage from flowing wells has been reported.

Water Quality

Water from the Tchefuncta aquifer in the Franklinton area is generally soft, with high iron and moderate pH. Iron concentrations from two wells (Wa-108 and Wa-38) are 1.3 and 1.8 mg/L, respectively. Dissolved manganese is less than 0.05 mg/L, and hardness is less than 12 mg/L. Dissolved solids and pH range from 99 to 112 mg/L and 6.3 to 6.8 units, respectively. Chloride concentrations for both wells are less than 5.0 mg/L.

Ramsay Aquifer

There is one major aquifer in the Franklinton area for which aquifer-characteristic, water-level, or water-quality data are not available. This sand correlates with the Ramsay aquifer that is present in Bogalusa and that was identified by Nyman and Fayard (1978, p. 58-60) in Tangipahoa and St. Tammany Parishes.

The Ramsay aquifer is continuous and contains freshwater throughout the Franklinton area. The aquifer thickens to the south and east and thins to the north and west of Franklinton. Depth to the top of the aquifer in the Franklinton area ranges from 1,570 to 1,785 ft below land surface at wells Wa-89 and Wa-57, respectively. Thickness of sand in the aquifer ranges from 185 ft at well Wa-89 to 420 ft at well Wa-88.

Dissolved iron and manganese concentrations in water from the Ramsay aquifer in the Bogalusa area (well Wa-81) are 1.0 and 0.10 mg/L, respectively. Dissolved solids are 113 mg/L, and pH is 6.7 units. Nyman and Fayard (1978, p. 59) note that iron concentrations in the Ramsay aquifer in St. Tammany Parish range from 0.03 to 0.59 mg/L, and dissolved solids range from 151 to 184 mg/L. Thus, the Ramsay aquifer in Franklinton may contain water with iron concentrations high enough to require treatment for general use.

The water level in well ST-652 (about 7 mi south of Folsom) was about 85 ft above land surface (129 ft NGVD) in 1977. The water level in well Wa-81 (at Bogalusa) was also above land surface, which is about 100 ft NGVD. Thus, water levels in wells tapping the Ramsay aquifer in Franklinton (about 155 ft NGVD) may not be above land surface.

Further study to include obtaining water-level, aquifer-characteristic, and water-quality data of this potentially valuable aquifer is warranted.

Franklinton Aquifer

Extent, Lithology, and Thickness

The Franklinton aquifer has been discussed in detail by Nyman and Fayard (1978, p. 60-62). They report that the typical range in thickness for the predominantly medium to coarse sand is 100 to 250 ft. The Franklinton aquifer contains salty water in the extreme southwestern part of the parish. Depths to the top of the aquifer in the immediate Franklinton area range from 2,265 to 2,580 ft below land surface at wells Wa-89 and Wa-57, respectively. Net sand thicknesses for wells in the area range from 155 ft at well Wa-57 to 250 ft at well Wa-89.

Well Yields and Aquifer Characteristics

The highest reported yield from a well tapping the Franklinton aquifer in the Franklinton area was 1,300 gal/min from a 12-inch public-supply well (Wa-88) in 1971; well Wa-57 (also a 12-inch public-supply well) produced 1,150 gal/min in 1957. Nyman and Fayard (1978, p. 60) calculated a transmissivity of 39,000 ft^2/d, or 290,000 (gal/d)/ft, for the Franklinton aquifer at well Wa-57. The estimated hydraulic conductivity is about 250 ft/d, or 1,900 (gal/d)/ft^2. Based on these values, the calculated drawdown 2 mi from a well pumping at the present average rate of 300 gal/min would be only 1.5 ft after 1 year. The present rate of pumping is relatively small compared to the capacity of the aquifer to yield water.

Water Levels and Water Use

A hydrograph for well Wa-57 (based on Nyman and Fayard, 1978, p. 62) is shown in figure 7. Nyman and Fayard (1978, p. 61) note an increase

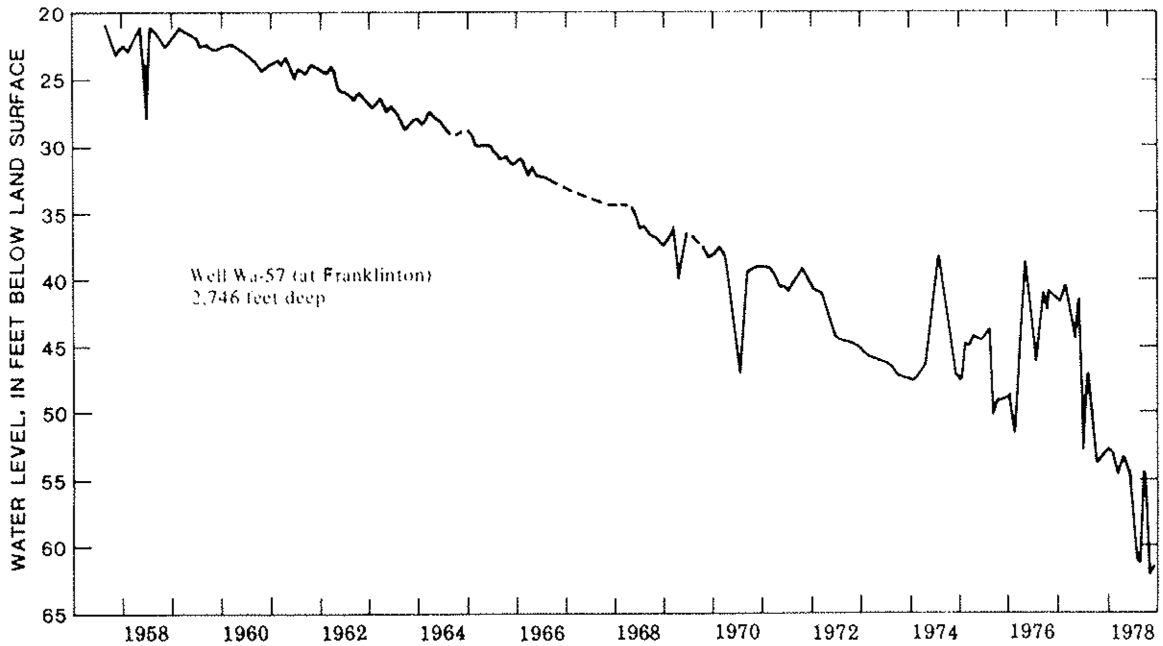

Figure 7.--Hydrograph for the Franklinton aquifer.

in the rate of decline from less than 1 ft/yr prior to 1962 to 1.7 ft/yr since then. They attribute the rise from 1974 to 1976 to local recovery near well Wa-57, caused by an increased reliance by Franklinton on water from well Wa-88. The sharp decline in 1978 was probably caused by well Wa-57 supplying a greater percentage of water for the town of Franklinton.

In 1974, about 0.5 Mgal/d was pumped from wells tapping the Franklinton aquifer in the Franklinton area. This includes pumpage by the town of Franklinton and the Rural Franklinton Water District.

Water Quality

Nyman and Fayard (1978, p. 62) noted dissolved solids in the Franklinton aquifer ranging from 240 to 280 mg/L, dissolved iron less than 0.1 mg/L, and hardness less than 10 mg/L. Values of pH for five analyses of water from four wells range from 8.2 to 9.1 units, and dissolved manganese ranges from 0.00 to 0.16 mg/L. Color of the water ranges from 20 to 30 units on the platinum-cobalt scale.

SUMMARY AND CONCLUSIONS

Washington Parish offers numerous freshwater-bearing aquifers. The total thickness of sand in freshwater aquifers ranges from 850 to 1,910 ft. The altitude of the base of freshwater ranges from 1,870 to 3,320 ft below NGVD.

The shallow aquifer, present throughout the parish, ranges in thickness from less than 50 ft to more than 400 ft. Wells completed in the shallow aquifer are capable of yields ranging from less than 20 gal/min to more than 2,900 gal/min (in selected areas). A major source of water for domestic and industrial wells, the shallow aquifer yielded more than 10 Mgal/d in 1974. Water from the shallow aquifer is generally low in dissolved-solids, iron, and manganese concentrations and generally is corrosive.

Eight aquifers have been identified in the Bogalusa area. They contributed more than 84 percent (26.4 Mgal/d) of the 1974 pumpage in Washington Parish. Water with generally low dissolved solids, iron, and manganese occurs in the "100-foot," "1,300-foot," "1,500-foot," and "2,200-foot" sands of the Bogalusa area. The pH values range from 5.2 to 8.8 units. Water from the "700-foot" sand and Ramsay aquifer is generally high in dissolved iron (0.86 to 2.7 mg/L); manganese ranges from 0.04 to 0.18 mg/L, pH ranges from 6.2 to 7.3 units, and dissolved solids are generally less than 123 mg/L. Water levels in wells tapping the "100-foot" sand are rising slightly, but water levels in the "1,500-foot" sand are declining at a rate of about 2.5 ft/yr. No data to identify water-level trends are available for the "1,300-foot" and "2,200-foot" sands.

The "100-foot," "1,300-foot," and "2,200-foot" sands of the Bogalusa area have a good potential for future development. Corrosive water in the "100-foot" sand and uncertainty of water-level trends in the "1,300-foot" and "2,200-foot" sands are possible limiting factors affecting potential development. The declining water-level trend (2.5 ft/yr) in wells in the "1,500-foot" sand and high iron concentrations in water in the "600-foot" and "700-foot" sands are factors that may limit future development of those sands.

Four major aquifers have been identified in the Franklinton area: the Kentwood, Tchefuncta, Ramsay, and Franklinton aquifers. Wells tapping the Kentwood aquifer have a slight declining trend of 0.25 ft/yr. Water levels in wells in the Tchefuncta aquifer are declining at a rate of about 1 ft/yr. Wells completed in the Franklinton aquifer yield as much as 1,300 gal/min. A declining trend of 1.7 ft/yr has been noted in well Wa-57. Pumpage from the Franklinton aquifer averaged 0.5 Mgal/d. Water that is low in dissolved iron and manganese is found in the Kentwood and Franklinton aquifers; pH ranges from 6.2 to 9.1 units. Water from the Tchefuncta aquifer is generally high in dissolved iron (1.3 to 1.8 mg/L), but low in dissolved solids and manganese. The pH is typically about 6.7 units.

Although the water may be slightly corrosive, water-level trend, yield, and thickness data indicate that the Kentwood aquifer has a good potential for future development. High iron concentrations in water from the Tchefuncta aquifer may limit its future development. The Franklinton aquifer possesses the greatest potential for future development. Good water quality, relatively light current use, and potentially high well yields combine to provide an excellent aquifer for future use.

Future studies should include a continuation of monitoring of water-level fluctuations in wells in the shallow aquifer, the "1,500-foot" sand of the Bogalusa area, and the Franklinton aquifer. Monitoring water-level trends in wells in the "2,200-foot" sand and the "1,300-foot" sand of the Bogalusa area should begin. More data are needed for the "1,300-foot," "2,200-foot," and "2,400-foot" sands of the Bogalusa area and for the Ramsay aquifer in the Franklinton area. Water-level, aquifer-characteristic, and water-quality data for these aquifers are necessary to complete the assessment of the ground-water resources of Washington Parish.

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HYDROLOGIC DATA

Tables 1-3

Table 1.--Miscellaneous water-level measurements

Well number	Depth (ft)	Land surface altitude (ft)	Date measured	Water level, in feet above (+) or below land surface datum
SHALLOW AQUIFER				
Wa-79	310	192	10-29-75	+24.5
			6-15-76	+23.3
			10-19-76	+21.7
			5-25-76	+22.3
Wa-103	170	225	6-15-76	65.62
			7- 6-76	66.80
			10-19-76	66.77
			3-15-77	66.76
			4- 6-77	67.84
			5-25-77	66.68
Wa-109	323	105	11-20-75	+9.6
			6-16-76	+8.0
			10-19-76	+7.3
			5-25-77	+9.4
Wa-114	168	340	6-16-76	48.45
			10-19-76	49.13
			3-15-77	47.40
			4- 6-77	47.25
Wa-115	198	300	6-16-76	134.94
			10-20-76	136.13
			5- 5-77	135.44
Wa-116	172	180	6-16-76	16.63
			10-19-76	17.82
			5-25-77	15.07
"700-FOOT" SAND OF THE BOGALUSA AREA				
Wa-14	681	105	7- 8-76	+21.5
			8-17-76	+23.7
			10-20-76	+28.7
			5-26-77	+20.6
KENTWOOD AQUIFER				
Wa-78	585	150	10-19-76	+16.1
			5-25-77	+15.0
Wa-91	600	240	6-15-76	13.28
			7- 6-76	13.25
			10-19-76	14.34
			3-15-77	14.65
			4- 6-77	14.73
			5-25-77	14.78
TCHEFUNCTA AQUIFER				
Wa-108	165	1,030	11-19-75	+24.8
			6-15-76	+24.2
			10-19-76	+23.7
			5-25-77	+23.0
"1,300-FOOT" SAND OF THE BOGALUSA AREA				
Wa-44	1,434	71	10-20-76	43.85
			5-26-77	52.48
"1,500-FOOT" SAND OF THE BOGALUSA AREA				
Wa-92	1,650	110	8- 7-74	75.14
			10-20-76	78.25
			5-26-77	88.73
Wa-93	1,407	110	8- 7-74	36.38
			6-24-76	39.22
			10-20-76	36.50
			5-26-77	46.56
Wa-125	1,450	150	2-28-78	77.08
			4- 3-78	66.46
			5-25-78	66.85
			6-14-78	67.64
FRANKLINTON AQUIFER				
Wa-105	2,380	185	11- 5-75	98.23
			6-15-76	106.62
			5-25-77	105.27
Wa-88	2,700	185	10-19-76	69.7
			5-25-77	70.57
HYDRAULIC ZONE 1				
Wa-80	570	125	10-29-75	+21.1
			10-19-76	+19.6
			5-25-77	+19.1
HYDRAULIC ZONE 2				
Wa-87	730	80	10-20-76	+35.15
			5-26-77	+33.35

Table 1.--Miscellaneous water-level measurements--Continued

Well number	Depth (ft)	Land surface altitude (ft)	Date measured	Water level, in feet above (+) or below land surface datum	Well number	Depth (ft)	Land surface altitude (ft)	Date measured	Water level, in feet above (+) or below land surface datum
HYDRAULIC ZONE 2--Continued					HYDRAULIC ZONE 3				
Wa-107	457	260	11-20-75	78.55	Wa-60	2,077	128	10-30-75	1.89
			6-16-76	79.99				6-24-76	2.89
			10-19-76	80.74				5-26-77	5.44
			3-15-77	80.65	Wa-86	1,337	120	10-31-75	+4.3
			4- 6-77	80.70				10-20-76	+1.68
			5-25-77	80.66				5-26-77	+.85

Table 2.--Miscellaneous data for selected wells

Local well number	Owner	Altitude (ft)	Casing diameter (in.)	Screened interval 1/	Discharge (gal/min)	Date discharge measured	Water level 2/	Date water level measured	Aquifer
Wa-5	Crown Zellerbach Corp	100	20	504- 729	2,520	1943	---	----	"700-foot" sand.
Wa-6	-----do	100	22	104- 170	2,960	1935	26	1935	"100-foot" sand.
Wa-7	-----do	100	24	525- 600	2,000	1960	9	1960	"600-foot" sand.
Wa-13	-----do	95	20	90- 156	-----	----	13	1961	"100-foot" sand.
Wa-14	City of Bogalusa	105	12	580- 681	1,000	1942	+21	1942	"700-foot" sand.
Wa-15	-----do	98	12	688- 769	1,000	1942	+22	1942	Do.
Wa-18	Town of Franklinton	150	6	788	400	1949	+33	1949	Tchefuncta.
Wa-33	City of Bogalusa	98	12	1,500	1,284	----	---	----	"1,500-foot" sand.
Wa-37B	Town of Franklinton	140	--	960- 970	-----	----	---	----	Tchefuncta.
Wa-38	-----do	150	6	992-1,050	-----	----	+44	1949	Do.
Wa-39	Crown Zellerbach Corp	105	12	525- 608	-----	----	---	----	"600-foot" sand.
Wa-41	City of Bogalusa	105	12	1,352-1,442	1,100	1950	+28	1950	"1,500-foot" sand.
Wa-42	Crown Zellerbach Corp	100	20	172	1,280	1950	19	1950	"100-foot" sand.
Wa-43	V. A. Talley	80	2	420	60	1950	+29	1950	Shallow.
Wa-44	City of Bogalusa	71	18	1,235-1,434	650	1951	+21	1951	"1,300-foot" sand.
Wa-49	Crown Zellerbach Corp	100	24	607- 748	1,650	1957	12	1957	"700-foot" sand.
Wa-50	-----do	100	24	114- 154	1,800	1952	52	1952	"100-foot" sand.
Wa-53	City of Bogalusa	80	16	1,453-1,557	2,000	1956	+15	1956	"1,500-foot" sand.
Wa-54	Crown Zellerbach Corp	97	24	94- 159	1,150	----	---	----	"100-foot" sand.
Wa-55	-----do	95	--	1,446-1,514	290	1957	+23	1957	"1,500-foot" sand.
Wa-56	-----do	97	--	1,318-1,376	1,650	1958	---	----	"1,300-foot" sand.
Wa-57	Town of Franklinton	160	12	2,614-2,746	1,150	1957	21	1957	Franklinton.
Wa-58A	Crown Zellerbach Corp	98	13	2,045	2,000	1960	35	1960	Ramsay.
Wa-58B	-----do	98	20	2,201-2,303	-----	----	---	----	"2,200-foot" sand.
Wa-59	-----do	95	20	2,177-2,292	2,500	1964	+18	1964	Do.
Wa-61D	Louisiana Office of Public Works	142	4	250- 264	39	1967	14	1967	Shallow.
Wa-65B	-----do	90	2	2,110-2,120	20	1970	+36	1970	Ramsay.
Wa-66B	-----do	120	2	1,494-1,504	40	1970	16	1970	Hydraulic zone 3.
Wa-81	Crown Zellerbach Corp	85	22	1,826-1,946	2,900	----	---	----	Ramsay.
Wa-82	-----do	90	20	2,159-2,279	-----	----	26	1970	"2,200-foot" sand.
Wa-87	Dan Williams	80	2	730	-----	----	+36	1970	Hydraulic zone 2.
Wa-88	Town of Franklinton	185	12	2,557-2,700	1,300	1971	63	1971	Franklinton.
Wa-89	Louisiana Office of Public Works	218	4	2,325-2,335	30	1973	104	1973	Do.
Wa-91	U.S. Geological Survey	240.	2	580- 600	2,074	1973	13	1974	Kentwood.
Wa-92	City of Bogalusa	110	16	1,503-1,650	-----	----	75	1974	"1,500-foot" sand.
Wa-93	-----do	100	16	1,295-1,407	2,260	1973	36	1974	Do.
Wa-102	L.S.U. Experiment Station	225	6	140- 175	-----	----	64	1975	Shallow.
Wa-103	-----do	225	6	140- 170	-----	----	65	1975	Do.
Wa-104	-----do	225	8	235	500	1970	---	----	Do.
Wa-105	Franklinton Rural Water Co-op	218	6	2,280-2,380	-----	----	98	1975	Franklinton.
Wa-108	Jence Bickham	165	2	1,030	-----	----	+25	1975	Tchefuncta.
Wa-115	H. H. Ratliff	300	4	188- 198	-----	----	135	1976	Shallow.
Wa-124A	Louisiana Office of Public Works	100	4	2,044-2,064	70	1977	+4	1977	"2,200-foot" sand.
Wa-124B	-----do	100	4	1,153	75	1977	+4	1977	"1,300-foot" sand.
Wa-125	U.S. Geological Survey	150	2	1,440-1,450	10	1977	67	1977	"1,500-foot" sand.

1/In feet below land surface datum. Depth is bottom of screened interval. Depth given where screened interval not available.
2/In feet above (+) or below land surface datum.

	LOCAL IDENT-I-FIER	STATION NUMBER	DATE OF SAMPLE	DEPTH OF WELL, TOTAL (FEET)	TEMPER-ATURE (DEG C)	IRON, DIS-SOLVED (UG/L AS FE)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	SILICA, DIS-SOLVED (MG/L AS SIO2)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)
					SHALLOW AQUIFER AND "100-FOOT" SAND					
WA- 6	3S 13E 38	304636089512001	41-09-09	170	--	--	--	--	--	--
			46-05-21	170	--	--	--	35	--	--
WA- 13	3S 13E 38	304652089512201	46-05-21	156	--	--	--	45	--	--
WA- 19	2S 10E 51	305047090091801	45-04-25	180	20.0	--	--	--	2.9	1.3
			47-06-01	180	--	--	--	22	--	--
			49-05-13	180	--	--	--	--	--	--
WA- 35A	2S 10E 46	305036090092103	47-02-24	156	20.0	50	--	--	3.4	1.0
WA- 42	3S 13E 38	304640089512101	50-04-12	172	--	--	--	--	--	--
			77-03-16	172	21.5	40	50	10	7.5	1.5
WA- 54	3S 13E 36	304652089512301	57-07-03	159	21.0	--	80	34	11	2.8
WA- 61A	1S 14E 52	305756089484103	67-04-03	352	21.5	2200	--	13	1.9	.3
WA- 61D	1S 14E 52	305756089484104	67-04-08	264	21.0	440	--	10	1.7	.2
			67-05-05	264	21.0	150	--	11	1.2	.5
WA- 61E	1S 14E 52	305756089484105	77-01-07	270	19.5	40	0	8.3	1.2	.7
WA- 79	1S 10E 43	304926090083001	77-01-06	310	19.5	1500	83	50	4.6	1.1
WA- 85	4S 13E 2	304417089521401	70-02-11	370	22.0	500	--	--	--	--
WA- 109	4S 11E 52	304338090050301	77-01-07	323	19.5	10	0	37	3.1	.8
WA- 119	1S 12E 18	305803090014601	77-01-07	120	19.5	0	0	10	1.2	.0
					"700-FOOT" SAND					
WA- 14	3S 13E 11	304756089514401	50-03-16	681	23.5	--	--	60	4.4	1.3
WA- 15	3S 13E 30	304613089513201	59-10-14	769	24.0	--	40	50	5.5	1.3
			77-03-16	769	23.5	2500	160	27	5.5	.6
WA- 40	3S 13E 36	304647089512201	46-05-21	724	--	--	--	60	--	--
			57-07-04	724	24.5	660	--	58	3.4	.4
					"1,300-FOOT" SAND					
WA- 56	3S 13E 38	304641089512101	58-01-22	1376	28.5	--	--	27	.6	.0
			76-06-17	1376	28.0	0	0	34	.3	.1
WA- 124B	3S 13E 1	304933089504102	77-09-08	1153	26.5	7	15	22	.8	.0
					"1,500-FOOT" SAND					
WA- 41	3S 13E 11	304756089514402	50-01-11	1442	--	--	--	--	--	--
			50-04-19	1442	28.0	--	--	60	--	--
			50-06-21	1442	28.0	--	--	48	.2	.3
			59-10-14	1442	27.5	--	--	44	.0	.0
			59-12-17	1442	28.0	--	--	--	--	--
WA- 53	3S 13E 38	304652089521401	68-02-07	1557	28.0	90	--	45	.0	.0
WA- 55	3S 13E 38	304652089512202	57-07-03	1514	29.0	--	--	44	.4	.0
WA- 92	2S 13E 27	304525089522801	77-01-07	1650	29.5	0	8	37	.0	.0
WA- 93	3S 13E 12	304813089505001	76-06-24	1407	28.0	30	0	47	.4	.0
					RAMSAY AQUIFER					
WA- 61	3S 13E 38	304651089512201	70-02-13	1946	31.5	1000	100	55	1.3	.4
					"2,200-FOOT" SAND					
WA- 56B	3S 13E 38	304645089512102	63-08-15	2303	33.5	--	--	25	.8	.2
			70-02-13	2303	33.5	90	110	--	--	--
WA- 59	3S 13E 38	304652089512101	64-11-03	2292	31.5	110	40	23	.8	.0
WA- 124A	3S 13E 1	304933089504101	77-08-25	2064	32.5	1000	15	32	.4	.2
					KENTWOOD AQUIFER					
WA- 18	2S 10E 46	305036090092101	45-04-25	788	21.5	--	--	46	6.8	2.1
			47-06-17	788	21.5	--	--	40	5.0	2.0
			56-02-29	788	22.0	--	--	56	4.7	1.5
			58-02-26	788	22.0	--	--	57	5.6	1.2
			77-01-06	788	20.5	160	75	51	6.0	.7
					TCHEFUNCTA AQUIFER					
WA- 36	2S 10E 46	305036090092102	49-07-15	217	--	--	--	10	3.8	.6
			56-02-29	217	23.0	--	--	60	2.2	.9
			58-02-26	217	--	--	--	--	--	--
			68-02-07	217	21.0	1800	--	53	2.1	1.2
WA- 168	2S 10E 44	305140090103801	76-06-15	1030	21.5	1300	50	53	3.2	1.0
					FRANKLINTON AQUIFER					
WA- 57	2S 10E 45	305124090093401	57-08-26	2746	--	--	--	--	--	--
			57-08-28	2746	--	--	--	18	1.1	.4
			57-09-12	2746	--	--	--	--	--	--
			58-02-26	2746	31.5	--	--	22	.8	.0
			59-01-10	2746	31.0	--	--	--	--	--
			59-02-12	2746	--	--	--	--	--	--
			61-01-10	2746	31.0	--	--	--	--	--
			62-01-09	2746	31.5	--	--	--	--	--
			68-02-07	2746	31.0	90	--	20	.8	.0
WA- 88	2S 11E 30	305059090062401	73-03-15	2700	30.5	60	5	8.1	.3	.4
			77-03-15	2700	30.5	20	130	9.5	.0	.0
WA- 89	2S 10E 55	305423090084801	73-09-25	2335	28.5	60	0	16	.4	.7
WA- 106	2S 10E 55	305423090084804	75-11-05	2380	30.5	90	23	53	.4	.0

OF WATER FROM SELECTED WELLS
1,000=MILLIGRAMS PER LITER (MG/L)]

SODIUM, DIS-SOLVED (MG/L AS NA)	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE (MG/L AS HCO3)	CAR-BONATE (MG/L AS CO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	NITRO-GEN, NITRATE TOTAL (MG/L AS NO3)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	HARD-NESS (MG/L AS CACO3)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	COLOR (PLAT-INUM-COBALT UNITS)
					SHALLOW AQUIFER AND "100-FOOT" SAND--Continued							
--	--	50	--	22	11	--	--	--	39	--	--	--
--	--	--	--	24	11	.2	--	--	48	--	--	5
--	--	--	--	20	4.0	.1	--	--	46	--	--	10
5.3	--	20	0	2.0	4.0	.0	--	20	13	--	--	--
--	--	8	--	--	3.0	--	--	--	0	--	5.7	--
--	--	--	--	--	3.5	--	--	--	--	40	--	--
11	--	28	0	2.0	8.0	--	--	--	13	5	6.4	--
--	--	--	--	--	36	--	--	--	24	--	6.2	7
19	3.4	36	0	24	9.0	.0	7.0	99	25	167	5.5	0
16	2.9	66	0	9.6	10	.0	--	119	39	161	5.7	0
3.0	.8	13	0	.6	3.7	.0	--	29	6	35	6.1	20
2.8	1.1	7	0	.0	2.5	.0	--	21	5	28	5.8	5
2.5	1.1	8	0	.0	4.1	.1	--	24	5	26	5.6	15
1.5	.7	4	0	3.4	2.8	.0	1.2	22	6	25	5.2	0
6.6	3.9	26	0	12	1.9	.0	.22	93	16	78	7.0	--
--	--	--	--	--	12	--	--	--	36	--	6.4	--
5.0	2.6	26	0	.0	2.7	.1	.00	64	11	52	--	0
1.9	.3	2	0	.2	3.5	.0	2.7	21	3	24	4.8	0
					"700-FOOT" SAND--Continued							
16	4.0	51	0	9.4	3.0	.1	--	123	16	113	7.3	--
14	2.7	47	0	7.6	3.3	.3	--	110	19	105	6.5	70
16	3.4	55	0	8.0	1.5	.1	.39	90	17	117	6.8	40
--	--	--	--	16	2.5	.2	--	--	28	--	6.6	20
18	2.7	46	0	8.2	3.8	.0	--	119	10	113	6.2	0
					"1,300-FOOT" SAND--Continued							
65	.5	154	2	9.4	3.2	.3	--	185	2	271	8.6	0
60	.4	145	0	9.4	3.5	.6	.32	180	1	261	8.2	5
58	.6	122	9	12	3.6	.1	.15	166	2	246	8.8	0
					"1,500-FOOT" SAND--Continued							
--	--	60	7	--	13	--	--	--	--	--	8.2	--
47	--	118	0	8.0	4.0	--	--	--	8	213	8.2	--
44	.8	105	0	9.3	4.5	.2	--	159	2	204	8.0	7
46	.2	102	0	9.4	3.7	.4	--	156	0	191	8.5	10
--	--	--	--	--	--	--	--	--	--	--	--	--
52	.3	119	0	9.6	4.1	.1	--	170	0	217	8.1	5
48	.4	104	0	8.6	6.8	.0	--	162	1	203	7.5	0
55	.3	126	0	11	3.2	.4	.00	169	0	244	8.4	0
41	.4	92	0	8.8	3.3	.4	.00	146	1	178	7.4	0
					RAMSAY AQUIFER--Continued							
19	2.6	45	0	10	2.6	.1	.10	113	5	104	6.7	0
					"2,200-FOOT" SAND--Continued							
49	1.3	119	0	6.6	2.8	.0	--	146	3	213	8.1	5
--	--	--	--	--	2.9	--	--	--	3	209	8.1	--
49	1.3	119	0	9.2	2.5	.1	--	146	2	203	7.0	0
46	1.3	114	0	8.6	2.1	.1	.00	147	2	201	7.3	20
					KENTWOOD AQUIFER--Continued							
6.9	5.3	37	0	11	4.0	.0	--	101	26	10	6.7	--
12	--	--	--	10	4.0	--	--	--	21	--	6.4	--
9.3	3.4	33	0	11	3.0	.1	--	106	18	93	6.4	15
7.5	3.6	30	0	12	2.0	.1	--	104	19	92	6.5	0
6.4	3.7	27	0	15	2.1	.1	.00	104	18	79	6.2	5
					TCHEFUNCTA AQUIFER--Continued							
17	--	38	0	9.8	5.5	--	--	--	13	--	6.4	--
14	3.0	35	0	10	3.2	.1	--	112	9	95	6.3	10
--	--	--	--	--	--	--	--	--	--	95	--	--
15	2.6	35	0	11	4.7	.2	--	107	10	91	6.8	5
11	3.4	30	0	10	2.3	.2	.00	99	12	83	6.5	5
					FRANKLINTON AQUIFER--Continued							
--	--	--	--	--	26	--	--	--	4	--	9.0	--
108	--	244	6	2.0	18	--	--	274	4	417	8.5	--
--	--	--	--	--	20	--	--	--	8	--	--	--
98	.6	218	4	6.2	14	.8	--	255	2	405	8.4	3
--	--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	15	--	--	--	3	391	--	--
--	--	--	--	--	15	--	--	--	0	398	--	--
90	.3	223	0	6.0	10	.4	--	238	2	385	9.1	30
95	2.0	212	0	5.2	20	.8	.60	236	2	375	8.6	20
92	1.0	211	4	5.4	15	.6	.47	232	0	390	8.2	20
110	1.0	277	0	11	4.6	1.1	.10	281	4	429	8.2	30
100	1.3	242	7	7.2	2.0	.9	.41	291	1	420	8.7	20

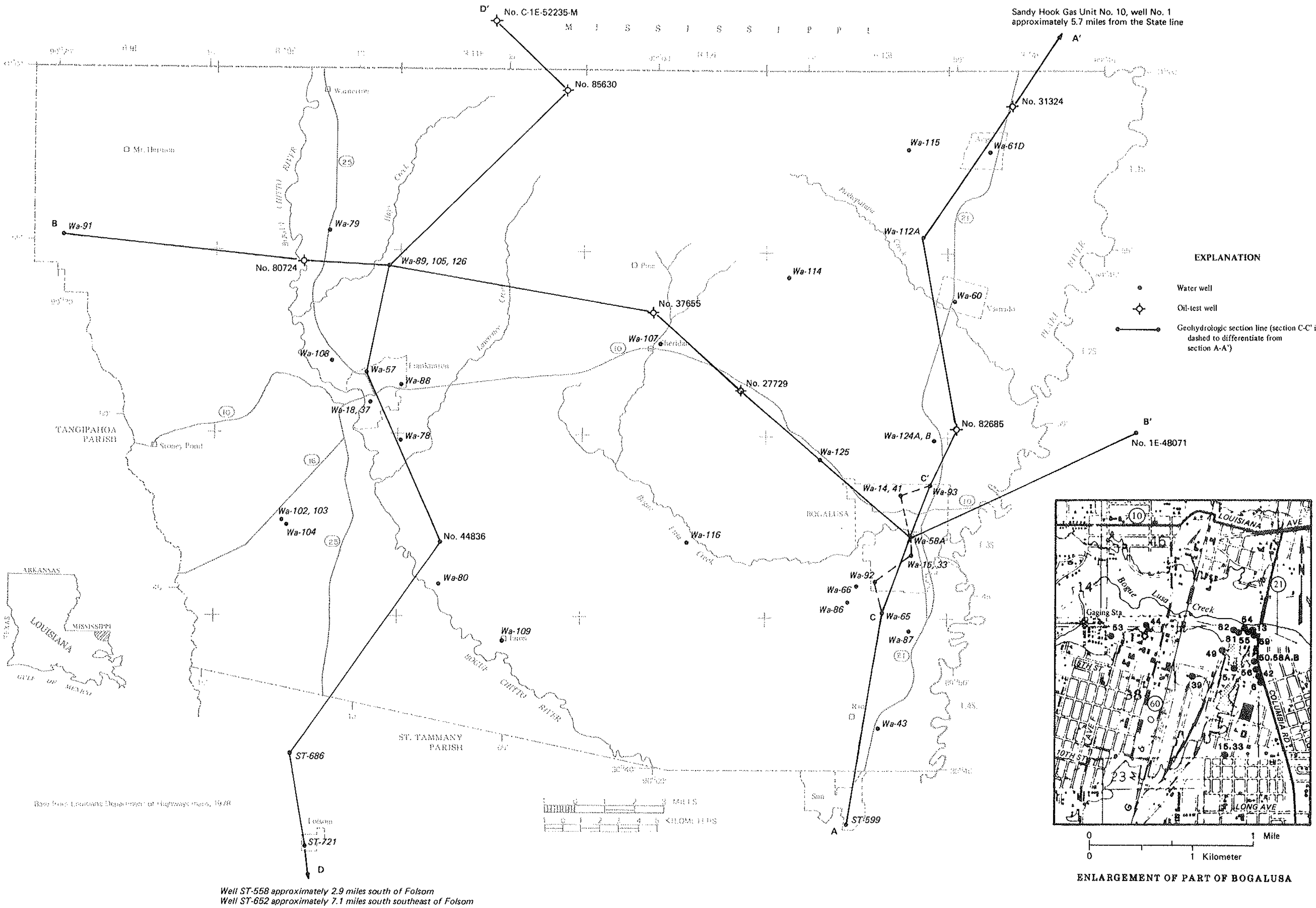

PLATE 1. MAP SHOWING LOCATIONS OF GEOHYDROLOGIC SECTIONS, WATER WELLS, AND OIL-TEST WELLS OF WASHINGTON PARISH, LOUISIANA.

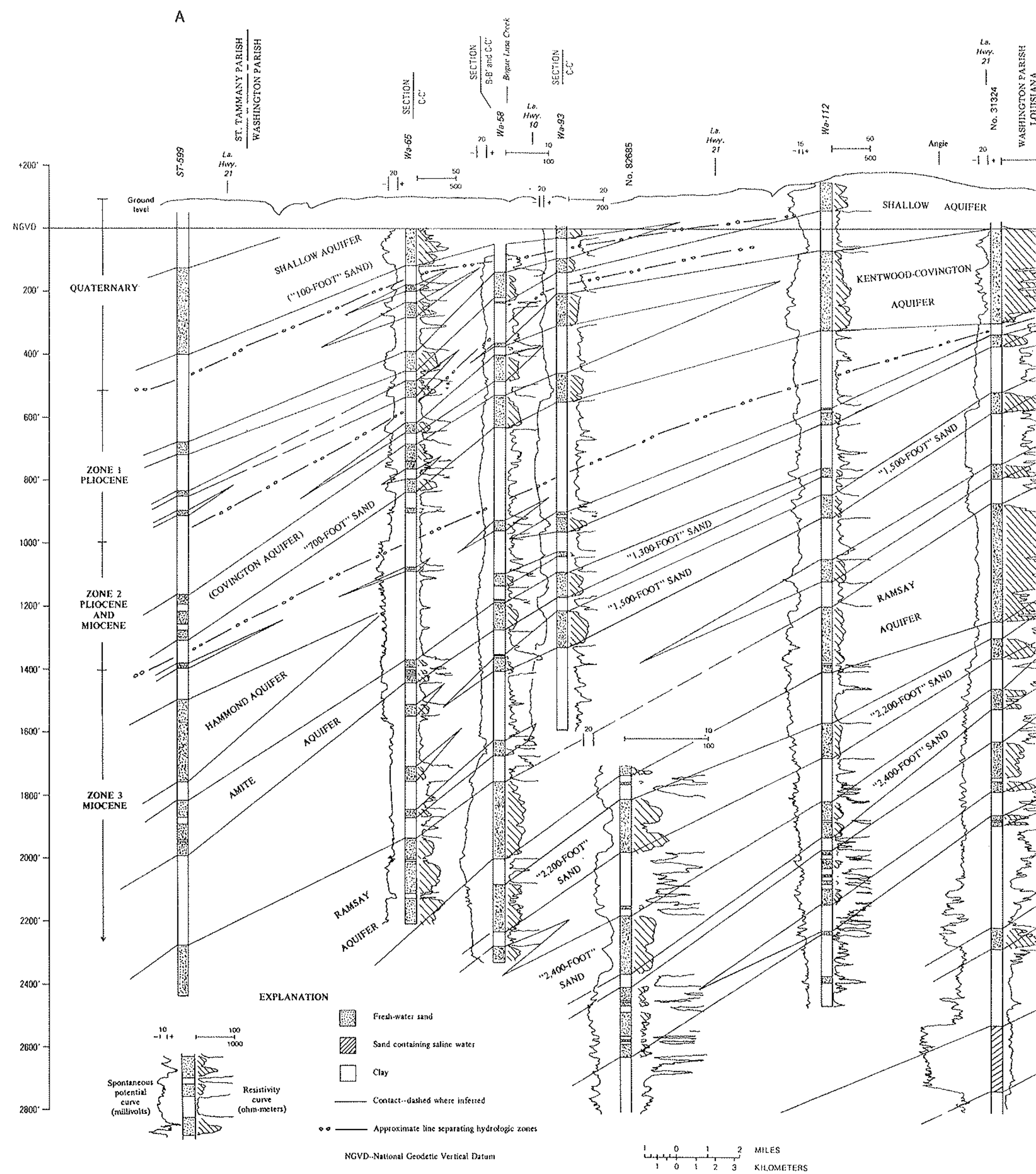

PLATE 2. NORTHWARD-TRENDING GEOHYDROLOGIC SECTION ACROSS EASTERN WASHINGTON PARISH, LOUISIANA.

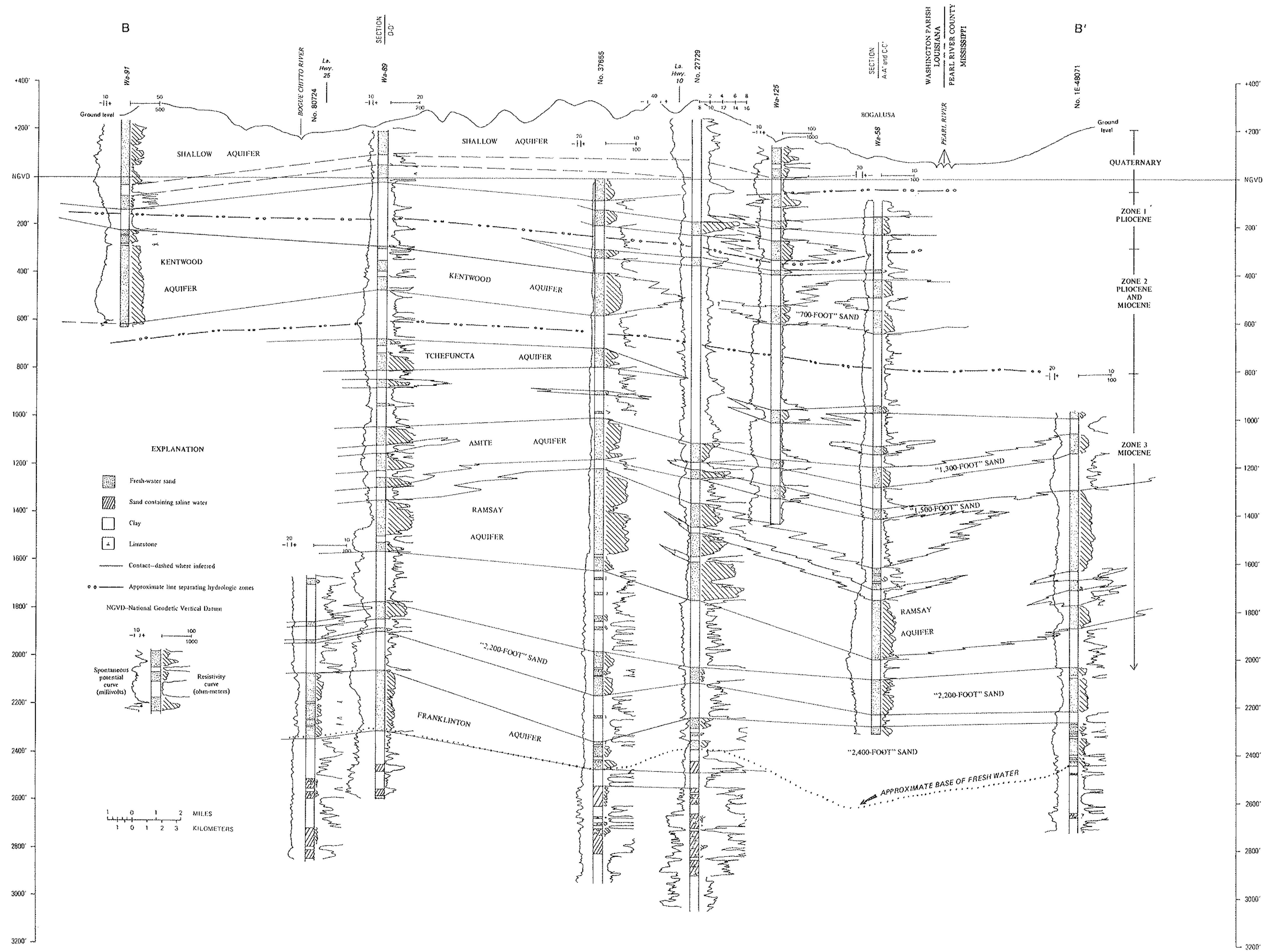

PLATE 3. EASTWARD-TRENDING GEOHYDROLOGIC SECTION ACROSS CENTRAL WASHINGTON PARISH, LOUISIANA.

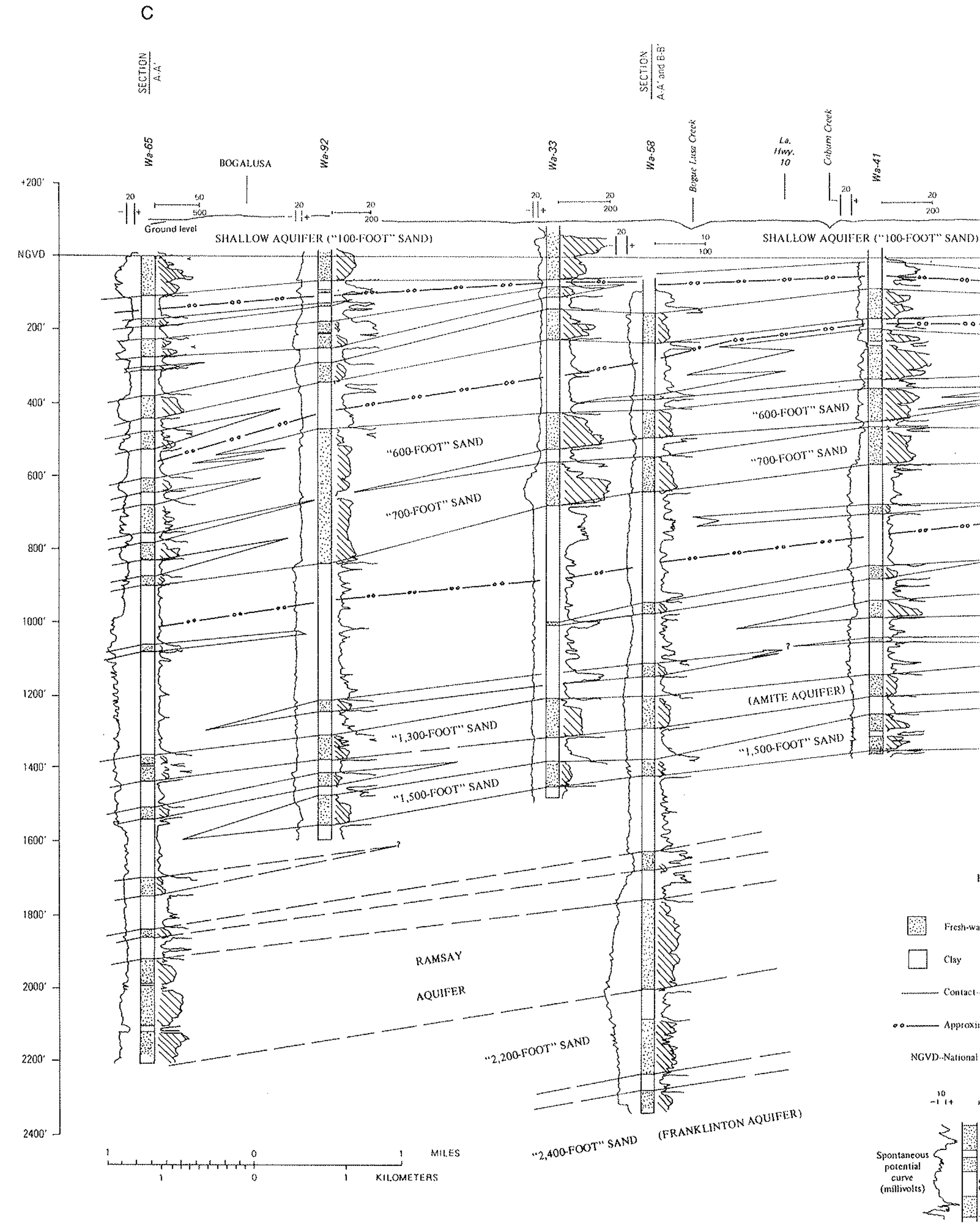

PLATE 4. NORTHWARD-TRENDING GEOHYDROLOGIC SECTION THROUGH BOGALUSA, LOUISIANA.

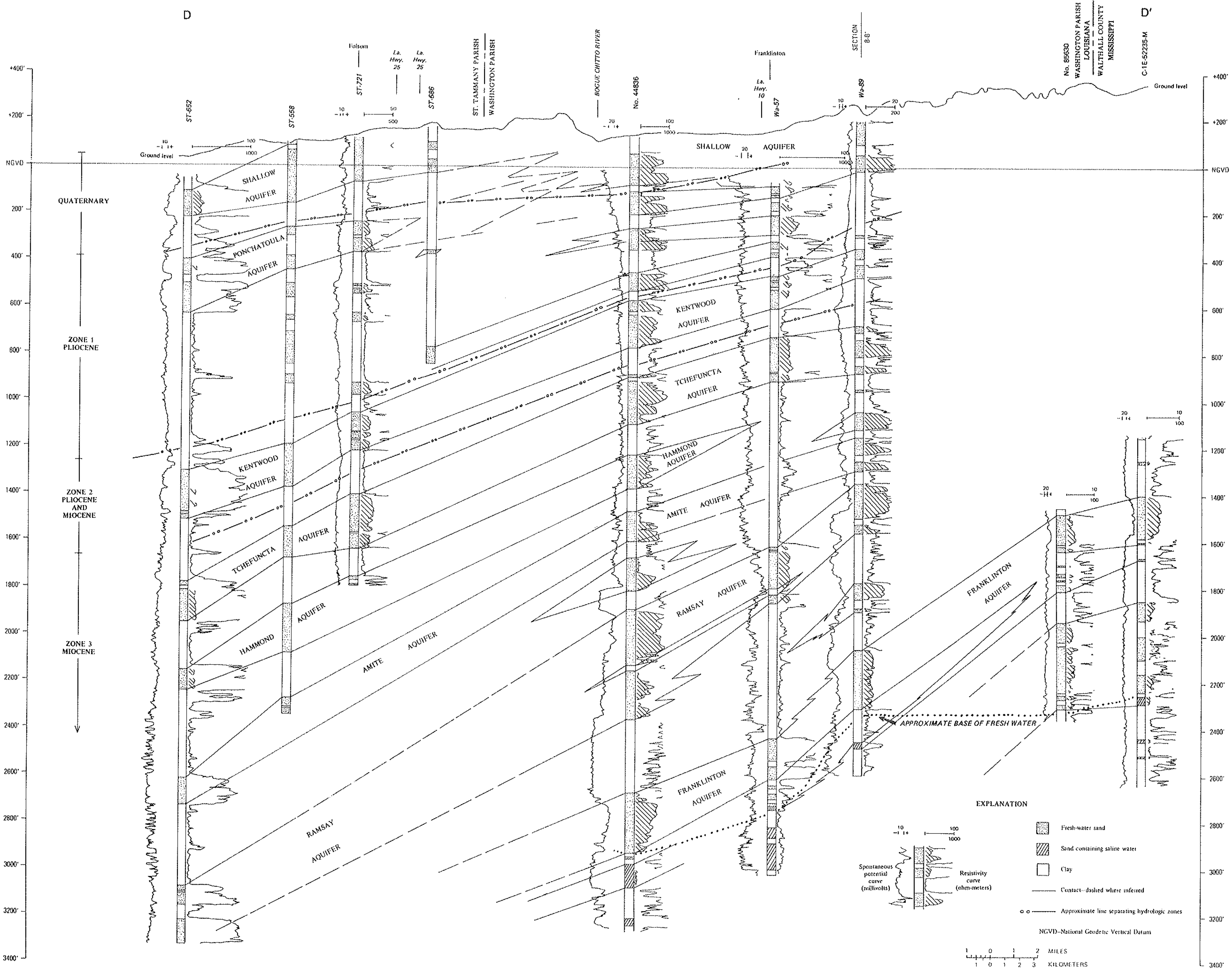

PLATE 5. NORTHWARD-TRENDING GEOHYDROLOGIC SECTION ACROSS WESTERN WASHINGTON PARISH, LOUISIANA.

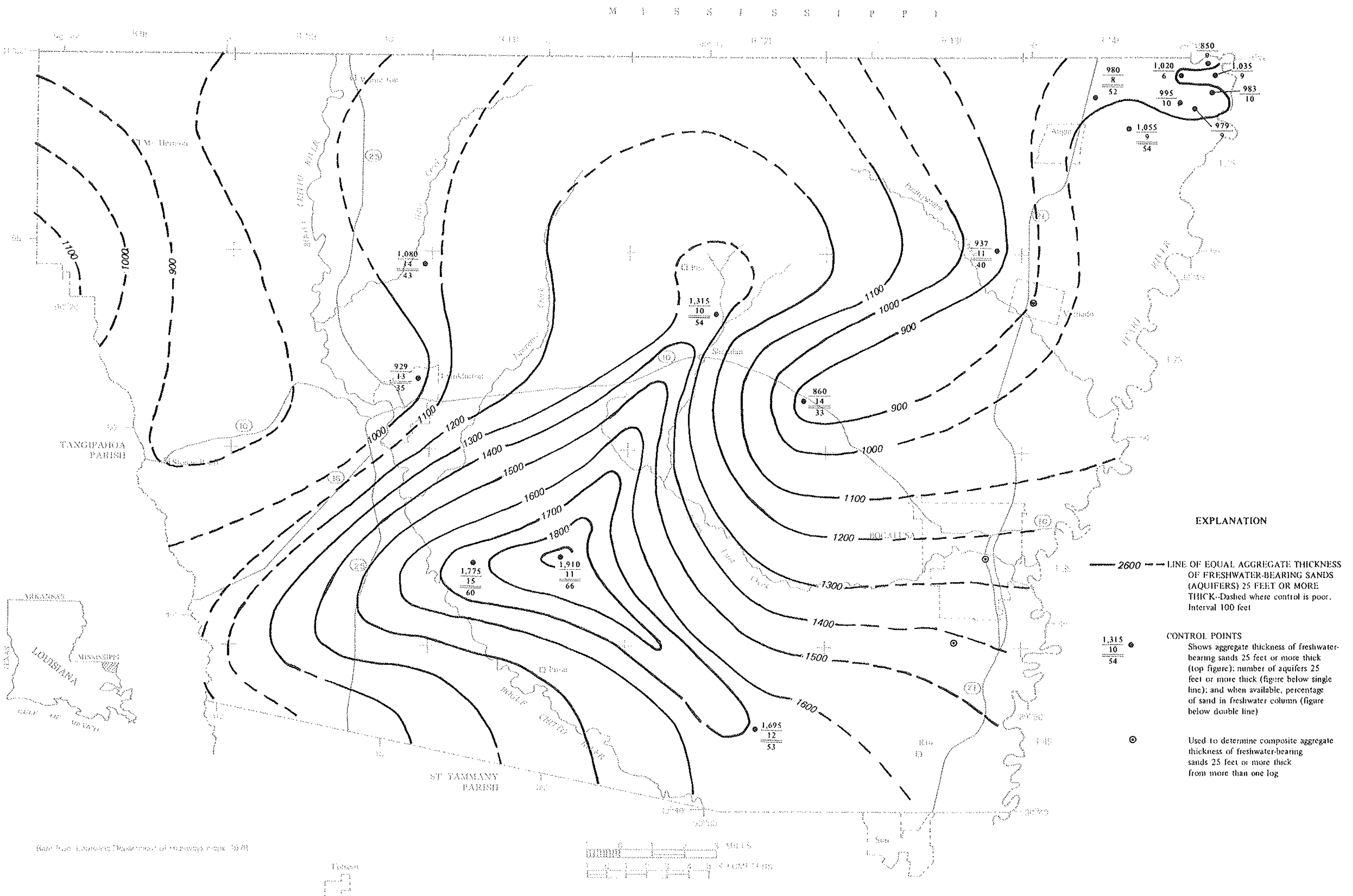

PLATE 6. MAP SHOWING THE AGGREGATE THICKNESS OF THE FRESHWATER-BEARING SANDS IN WASHINGTON PARISH, LOUISIANA.

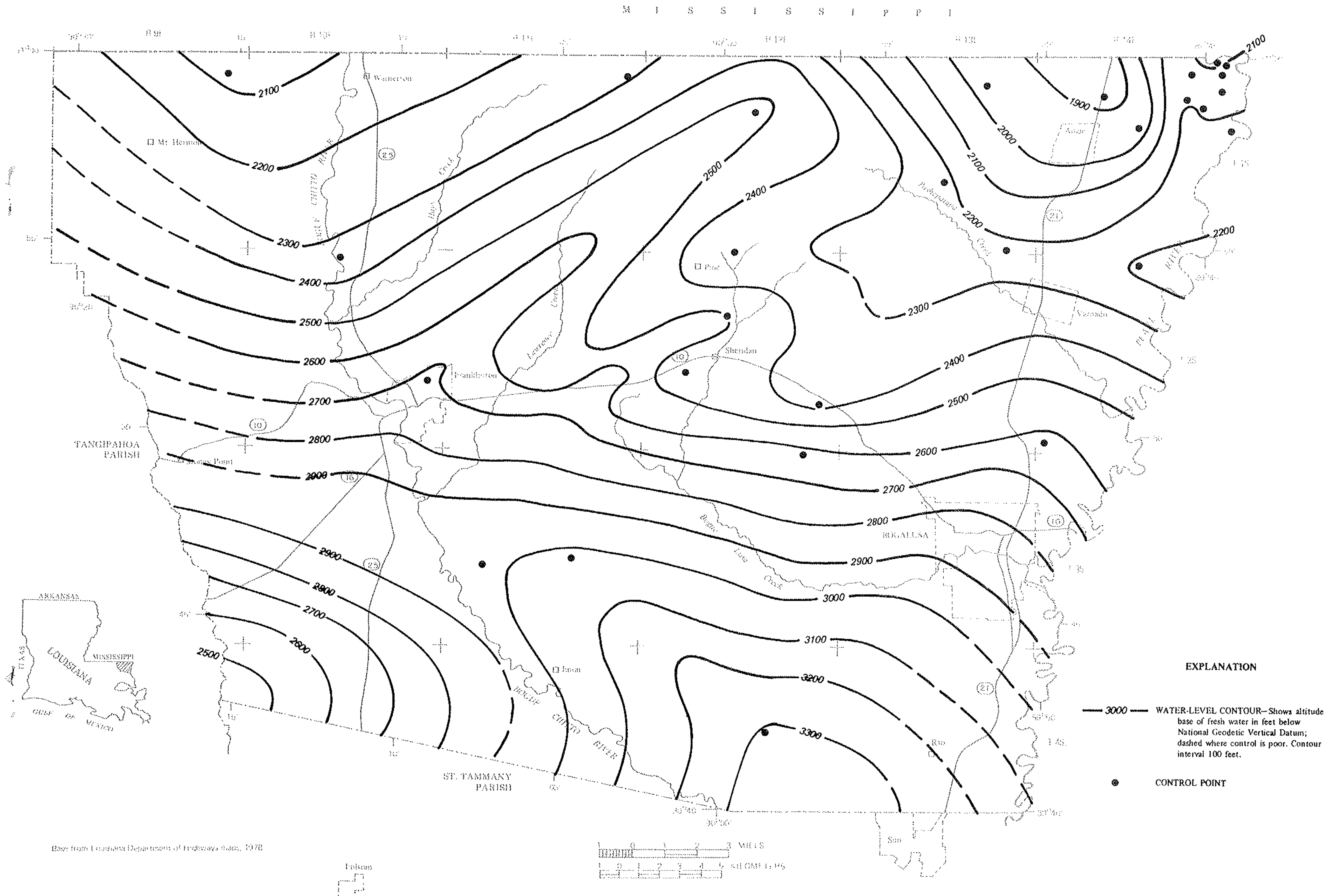

PLATE 7. MAP SHOWING THE ALTITUDE OF THE BASE OF FRESH GROUND WATER IN WASHINGTON PARISH, LOUISIANA.